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MILITARY POTENTIAL TEST OF NOISE SUPPRESSOR, HEL, M4, FOR M16A1 RIFLE

FINAL REPORT

By

MAJOR WILLIAM R. LEE

1LT GENE W. COLE

APRIL 1968

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UNITED STATES ARMY INFANTRY BOARD
Fort Benning, Georgia 31905

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APPROVED:

JAMES I. MUIR, JR.
Colonel, Infantry
President

UNITED STATES ARMY INFANTRY BOARD
Fort Benning, Georgia 31905

ABSTRACT

The Military Potential Test of the Noise Suppressor, HEL, M4, for the M16A1 Rifle, was conducted by the United States Army Infantry Board from 1 February 1968 to 26 March 1968 at Fort Benning, Georgia. The purpose of this test was to evaluate the advantages and/or disadvantages of the noise suppressor in realistic operational exercises characteristic of Vietnam environments with respect to such factors as position disclosing effects, system functioning, durability, reliability, and maintenance. Fifteen M16A1 rifles with noise suppressors attached were used to conduct this test. Fifteen standard M16A1 rifles were used for control purposes.

Specific phases of testing under temperate climatic conditions included physical characteristics; safety; signature effects; known distance accuracy; quick fire; durability and reliability; portability and aerial delivery; maintenance; human factors engineering; and value analysis.

There were no deficiencies. Three shortcomings were noted: the gas deflector failed to deflect all of the escaping gases from the firer's eyes; the ejection pattern of the M16A1 rifle with the noise suppressor attached caused the expended cartridge to strike the cheek of left-handed firers; and the malfunction rate of the test weapon was significantly higher than the control weapon during automatic fire.

It was concluded that the Noise Suppressor, HEL, M4, had military potential and accomplished the purpose for which it was designed, i.e., to deceive observers located forward of the test weapon as to the location of the weapon when it is fired.

It was recommended that the Noise Suppressor, HEL, M4, be considered as having military potential, and further development be directed toward correction of the shortcomings.

FOREWORD

The United States Army Infantry Board was responsible for preparing the test plan, test execution, and preparing the test report.

TABLE OF CONTENTS

SECTION 1. INTRODUCTION

1.1 BACKGROUND

1.1.1 In May 1966 the United States Army, Vietnam (USARV), submitted an Expediting Non-Standard Urgent Requirement for Equipment (ENSURE) request (DA ENSURE Index No 77) for silencers for the M16A1 rifle. In response to this request, the US Army Human Engineering Laboratories (USAHEL), Aberdeen Proving Ground, Maryland, designed and tested a noise suppressor. This test was completed in November 1967, and after reviewing the results, the US Army Test and Evaluation Command (USATECOM) recommended that the suppressor "be considered safe to fire and suitable for field testing."

1.1.2 The Commanding General, US Army Materiel Command (USAMC), directed more intensive and extensive evaluation and exposure of the suppressor to realistic field use for increased assurance as to capability and limitations prior to approval for operational use in Vietnam.

1.1.3 On 5 January 1968 the Project Manager, Rifles, USAMC, Rock Island, Illinois, requested USATECOM to conduct a field evaluation of the noise suppressor.

1.1.4 On 25 January 1968 USATECOM directed the US Army Infantry Board (USAIB) to conduct a military potential test of the noise suppressor for the M16A1 rifle.

1.1.5 The materiel for test was received on 31 January 1968. Testing began on 1 February 1968 at Fort Benning, Georgia, and was completed on 26 March 1968.

1.2 DESCRIPTION OF MATERIEL (See Appendix II for photographs)

1.2.1 The Noise Suppressor Assembly, HEL, M4, hereinafter referred to as the test item, consists of a steel cylinder with three mounting screws and a separate rear support. It has no moving parts, is 12 inches long, and weighs 1.8 pounds (fig 1 and 2, app II). A phosphate coating on all exposed parts offers resistance to rust. Once installed, the test item becomes an integral part of the weapon and should not be removed. The Rifle, 5.56-mm, M16A1, with the test item attached, is hereinafter referred to as the test weapon (fig 3, app II).

1.2.2 Certain modifications were necessary to the M16A1 rifle to allow installation of the test item and to insure proper functioning of the rifle. The test item replaced the flash suppressor of the rifle, and a third gas pressure relief port was added to the bolt carrier to compensate for higher gas pressures within the weapon and

to maintain the proper cyclic rate. In addition, a gas deflector was clip-mounted onto the rifle charging handle to deflect escaping gases from the firer's eyes (fig 4 thru 6, app II).

1.3 TEST OBJECTIVES

1.3.1 To evaluate the advantages and/or disadvantages of the test item in realistic operational exercises characteristic of Vietnam environments.

1.3.2 To determine:

a. Performance characteristics and to verify effects of operation as relates to suppression of noise, position disclosing effectiveness, marksmanship, night operations, and safety precautions under field conditions.

b. The effects the test item has upon system functioning, reliability, maintenance, accuracy and lethality of the M16A1 rifle. (USAIB was unable to determine the effect the test item has upon lethality.)

c. Maintenance requirements for field use as relates to both the test item and M16A1 rifle.

d. Whether the test item has military potential.

1.4 SUMMARY OF RESULTS

1.4.1 No deficiencies were noted.

1.4.2 Three shortcomings were noted:

a. The failure of the gas deflector to deflect all of the escaping gases from the firer's eyes (Subtest No 2).

b. The ejection pattern of the test weapon caused the expended cartridge to strike the right cheek of left-handed firers, thereby creating a safety hazard (Subtests No 2 and 9).

c. The test weapon exhibited a significantly higher malfunction rate than the control weapon during automatic fire (Subtest No 6).

1.4.3 The test item increased the over-all length of the M16A1 rifle by 5 inches and the weight by 1.58 pounds (Subtest No 1).

1.4.4 Attachment of the test item to the M16A1 rifle caused a significant decrease in the muzzle noise and flash level of the test weapon (Subtest No 3).

1.4.5 Observers located forward of the test weapon were deceived as to the location of the weapon when it was fired (Subtest No 3).

1.4.6 The known distance accuracy and quick-fire performances of the test and control weapons were comparable (Subtests No 4 and 5).

1.4.7 The man-portability of the M16A1 rifle is degraded when the test item is attached because of the additional weight and the change in the center of balance of the weapon (Subtest No 7).

1.4.8 The individual weapons container should be used to protect the test weapon against damage when jumped with the individual parachutist (Subtest No 7).

1.4.9 The test weapons require more frequent and detailed care and cleaning than the control weapons. Periodic inspection of the test item mounting screws and bore alignment is also necessary (Subtest No 8).

1.5 CONCLUSIONS

The United States Army Infantry Board concludes that:

a. The test item does have military potential.

b. The test item accomplishes the purpose for which it was designed, i.e., to deceive observers located forward of the test weapon as to the location or the weapon when it is fired.

1.6 RECOMMENDATIONS

The United States Army Infantry Board recommends that:

a. The Noise Suppressor Assembly, HEL, M4, be considered as having military potential.

b. Further development be directed toward correction of the shortcomings.

SECTION 2. DETAILS OF TEST

2.1 INTRODUCTION

2.1.1 Definitions

When the following terms are used in conjunction with test results, the definitions shown here will apply.

a. Malfunction: Failure of weapon to function properly.

b. Binding: Any resistance experienced when the alignment gage is inserted into the test item attached to a weapon.

2.1.2 Test Items

Fifteen test weapons were received by USAIB for test.

2.1.3 Control Items

Fifteen Rifles, 5.56-mm, M16A1, were received by USAIB for use as control weapons.

2.1.4 Each appropriate subtest was conducted using M193 ball ammunition (Lot No LC 12298 and Lot No LC 18250) with ball propellant and M196 tracer ammunition (Lot No TW 18047) using IMR propellant.

2.1.5 Test Soldiers

Thirty test soldiers were used in this project and were representative of those who would normally be expected to operate and maintain the test weapons in the field. Fifteen test soldiers were used as firers and each firer was assigned a test and control weapon.

2.1.6 Test Location

Testing was conducted at Fort Benning, Georgia, under the prevailing temperate conditions.

2.1.7 Test and Analysis Methodology

Each applicable subtest was conducted so that test and control weapons were represented at any given time of the exercise. An analysis of variance was run on the dependent variables of extreme spread and mean radius data gathered, during the Known Distance Accuracy Subtest (Subtest No 4), to determine if a significant difference existed between weapons at the various ranges with respect to the dependent variables. An analysis was also conducted to see if weapons performance changed significantly with respect to the dependent

variables; and if weapons performance changed significantly with respect to these variables where times of usage becomes another factor.

2.2 SUBTEST NO 1, PREOPERATIONAL INSPECTION AND PHYSICAL CHARACTERISTICS

2.2.1 Objectives

2.2.1.1 To determine if the test and control weapons were complete and in proper condition for testing.

2.2.1.2 To determine the size, configuration, and weight of the test item and accessories.

2.2.2 Method

2.2.2.1 The test and control weapons were inspected for completeness, serviceability, and any evidence of damage.

2.2.2.2 Each of the test and control weapons was function fired with a minimum of two 20-round magazines (one semiautomatic, one automatic) of each type of ammunition provided.

2.2.2.3 The test and control weapons were photographed, weighed, and measured, and the data recorded and compared.

2.2.3 Results

2.2.3.1 Photographs of the test and control weapons are shown in Appendix II.

2.2.3.2 The test and control weapons were complete and in proper condition for testing except for two test weapons which exhibited a misalignment of the suppressor with the bore when checked with the alignment gage (fig 9, app II). In the subsequent function firing of these two weapons, an inspection of the suppressor endcap holes revealed a slight chipping or peening effect caused by the strike of the bullets (fig 10, app II). A technical inspection of one of these test weapons, conducted later in the test, by direct support personnel revealed that the barrel was bent and it was subsequently withdrawn from further testing; however, this condition had no adverse effect on the operational efficiency and effectiveness of the other test weapon.

2.2.3.3 The average dimensions and weights of the test and control weapons were as follows:

TABLE 1

LENGTH AND WEIGHT OF TEST AND CONTROL WEAPONS

	Length (in)	Weight, Empty, with Sling (lb)	Weight, Full Magazine, with Sling (lb)	Weight, Full Magazine, with Sling and Bipod (lb)
Control Weapon	39	7.15	7.97	8.54
Test Weapon	44 1/8	8.73	9.85	10.41

2.2.4 Analysis

The test weapons, except for the one test weapon indicated in paragraph 2.2.3.2 above, and control weapons were serviceable and in proper condition for testing.

2.3 SUBTEST NO 2, SAFETY

2.3.1 Objective

To determine if the test weapons were safe for US Army use.

2.3.2 Method

Throughout all testing, data pertaining to the safety features of the test weapon were noted. Results were recorded and analyzed under this subtest.

2.3.3 Results

2.3.3.1 The gas deflector modification on the test weapon did not completely deflect all of the escaping gases from the firer's eyes. These gases were more noticeable during the automatic and rapid semiautomatic modes of fire and were a source of irritation to the firer.

2.3.3.2 The ejection pattern for the test weapon was different from that of the control weapon. The control weapon ejected the expended cartridges forward of the left-handed firer and at a sufficient distance to not represent a hazard; however, the test weapon ejected the expended cartridges rearward and in such a manner to represent a

hazard (fig 11, app II). On several occasions, the hot brass struck the left-handed firer on the right cheek, causing injury that ranged from discomfort to circular cuts in the flesh (fig 12, app II). The ejected brass also went down the left-handed firer's collar and caused discomfort from the heat.

2.3.4 Analysis

2.3.4.1 The failure of the gas deflector to perform its function efficiently is a shortcoming.

2.3.4.2 The ejection pattern of the test weapon constitutes a safety hazard to a left-handed firer. This is a shortcoming.

2.4 SUBTEST NO 3, SIGNATURE EFFECTS

2.4.1 Objective

To determine and compare the signature effects of the muzzle flash, muzzle noise, and smoke of the test and control weapons during daylight and darkness.

2.4.2 Method

2.4.2.1 Three control weapons and three test weapons were mounted in firing stands and fired in both the semiautomatic and automatic mode of fire during daylight and darkness. Observers were placed in safe positions 25 meters to the flanks of the firing position at 0 meters, 50 meters, 100 meters, and every 100 meters down range, from the firing line, to 600 meters to determine and compare the difference, if any, in the signature effects of the test and control weapons. Photographs, still, and motion picture, were made of the test and control weapons during the firing exercise.

2.4.2.2 Five test and five control weapons were fired through the Course described in Appendix B of the Interim Operation and Maintenance Manual (IOMM) (firing to the flanks and over the heads of observers) for the test weapon. The ability of observers to determine the azimuth and distance to the test and control weapons was noted. The course was fired during darkness. (Fig 13, app II).

2.4.2.3 During the conduct of all subtests particular attention was given to the effects of flash, muzzle noise, and smoke. Results were reported and analyzed under this subtest.

2.4.3 Results

2.4.3.1 The comparative performance of the test and control weapons with respect to signature effects (muzzle noise, muzzle flash, smoke) is depicted in Tables 2 through 5 based on questionaires (in the format of the tables) completed by each observer.

TABLE 2

SIGNATURE EFFECTS - TEST WEAPON, DAYLIGHT

	Noise Level				Flash Level				Smoke Level			
Meters	High	Moder-ate	Low	None	Bright	Moder-ate	Low	None	Heavy	Moder-ate	Low	None
0		X						X		X		
50				X				X			X	
100				X				X				X
200				X				X				X
300				X				X				X
400				X				X				X
500				X				X				X
600				X				X				X

TABLE 3

SIGNATURE EFFECTS - CONTROL WEAPON, DAYLIGHT

	Noise Level				Flash Level				Smoke Level			
Meters	High	Moder-ate	Low	None	Bright	Moder-ate	Low	None	Heavy	Moder-ate	Low	None
0	X							X		X		
50		X						X			X	
100			X					X			X	
200			X					X			X	
300			X					X				X
400			X					X				X
500			X					X				X
600			X					X				X

TABLE 4

SIGNATURE EFFECTS - TEST WEAPON, NIGHT

	Noise Level				Flash Level				Smoke Level			
Meters	High	Moder-ate	Low	None	Bright	Moder-ate	Low	None	Heavy	Moder-ate	Low	None
0			X				X					X
50			X				X					X
100				X			X					X
200				X				X				X
300				X				X				X
400				X				X				X
500				X				X				X
600				X				X				X

TABLE 5

SIGNATURE EFFECTS - CONTROL WEAPON, NIGHT

	Noise Level				Flash Level				Smoke Level			
Meters	High	Moder-ate	Low	None	Bright	Moder-ate	Low	None	Heavy	Moder-ate	Low	None
0	X						X					X
50		X					X					X
100		X					X					X
200		X						X				X
300		X						X				X
400		X						X				X
500		X						X				X
600		X						X				X

2.4.3.2 The test item caused a significant decrease in the muzzle noise

and flash level of the M16A1 rifle, but the smoke levels were comparatively the same. Also, difference was noted in the flash and smoke patterns of the test and control weapons. The flash observed from the control weapon was pear shaped and larger than the flash produced by the test weapon. The flash observed from the test weapon was pencil shaped and approximately 2 inches long (fig 14, app II). The test weapon normally produced a flash on the first round fired, if the weapon had not been fired for 10 minutes. Subsequent rounds fired did not produce a noticeable flash. During the initial firing of the test weapons, sparks were emitted in the vicinity of the bayonet stud of the weapon (the point at which the rear end of the noise suppressor abuts against the rifle). After approximately 3,000 rounds were fired through the test weapon and carbon deposits had formed, this spark was not observed. The standard flash suppressor on the control weapon dispersed smoke caused by firing and caused it to be dissipated more rapidly than that of the test weapon. Smoke caused as a result of firing the test weapon escaped through the aperture in the endcap of the suppressor in a thin column approximately 8 inches long before dispersing and evaporating.

2.4.3.3 The exercise described in paragraph 2.4.2.2 was conducted on 22 March 1968 under starlight conditions. The weather was overcast. The course, as fired, is depicted in figure 13, Appendix II. Observers were unable to estimate the azimuth and distance from the observer point to the firing point when the test weapons were fired. The observers were able to estimate, with a reasonable degree of accuracy, the azimuth and distance from the observer point to the firing point when the control weapons were fired. The observers were able to distinguish between the test and control weapons during firing because the test weapon did not produce the characteristic "thump" of the muzzle blast which normally accompanies the ballistic "crack" of the projectile.

2.4.4 Analysis

2.4.4.1 The level of the muzzle noise and flash of the test weapon is significantly lower than that of the control weapon; the smoke levels of the test and control weapons are comparable.

2.4.4.2 Observers, located forward of the test weapon, are deceived as to the location of the weapon when it is fired.

2.5 SUBTEST NO 4, KNOWN DISTANCE ACCURACY

2.5.1 Objective

To determine and compare the accuracy of the test and control man/weapons system at known distance ranges.

2.5.2 Method

2.5.2.1 After zeroing, 14 test soldiers each fired three 10-round groups (semiautomatic mode, sandbag-support, prone position), with the test and control weapons, at "A" type rifle targets located at each range of 100, 300, and 400 meters. The extreme spread, mean radius, and center of impact of each shot group were determined and the target was examined for keyhole rounds and indications of bullet yaw, erratic flight and possible bullet break-up. This exercise was repeated, at the 300-meter range only, half-way through the test and at the conclusion of the test.

2.5.2.2 After zeroing, 15 test soldiers each fired a 10-round group (semiautomatic and then automatic mode, (2- to 3-round bursts), sandbag-supported, prone position) with the test and control weapons at "M" type silhouette targets located at ranges of 100, 250, and 400 meters. The average number of target hits for the test and control weapons at each range was recorded.

2.5.2.3 The exercise described in paragraph 2.5.2.2 was repeated during darkness with the starlight scope mounted on the test and control weapons, except that nine each test and control weapons were fired in this exercise.

2.5.3 Results

2.5.3.1 The results of known distance accuracy firing with the test and control weapons at "A" type targets are depicted in Table 6 and figures 1 through 18, Appendix I. Due to zeroing and accuracy problems with one test weapon, averages shown in Table 6 are based on the firing of 14 firers.

TABLE 6

KNOWN DISTANCE ACCURACY
Semiautomatic Fire (Day)
(Average of 14 firers)

Range (Meters)	Total Rounds Fired	Test Weapon		Control Weapon	
		Mean Radius (inches)	Extreme Spread (inches)	Mean Radius (inches)	Extreme Spread (inches)
100	*420	2.57	8.61	2.16	7.19
300	*420	7.48	25.68	7.41	22.39
	**420	7.97	23.16	6.67	20.10
	***420	7.88	24.07	6.16	19.96
400	*420	10.39	31.89	8.74	26.72

* Beginning of test
** Midway in test
*** End of test

2.5.3.2 The results of known distance accuracy firing with the test and control weapons at "M" type silhouette targets during daylight are depicted in Tables 7 and 8.

TABLE 7

KNOWN DISTANCE ACCURACY
Semiautomatic Fire (Day)
(10-round Shot Group)
(Totals of 15 firers)

Type Weapon	Total Rounds Fired	Range (Meters)	Target Hits	Percentage of Hits
Test	150	100	144	96
	150	250	121	80
	150	400	69	46
Control	150	100	147	98
	150	250	114	76
	150	400	72	48

TABLE 8

KNOWN DISTANCE ACCURACY
Automatic Fire (Day)
(10-round Shot Group)
(Totals of 15 firers)

Type Weapon	Total Rounds Fired	Range (Meters)	Target Hits	Percentage of Hits
Test	150	100	97	60
	150	250	73	48
	150	400	42	28
Control	150	100	103	68
	150	250	67	44
	150	400	40	26

2.5.3.3 The results of known distance accuracy firing with the test and control weapons, with starlight scope attached, at "M" type silhouette targets during darkness are depicted in Tables 9 and 10.

TABLE 9

KNOWN DISTANCE ACCURACY
Semiautomatic Fire (Night)
(Totals of 9 firers)

Type Weapon	Total Rounds Fired	Range (Meters)	Target Hits	Percentage of Hits
Test	90	100	90	100
	90	250	73	81
	90	400	20	22
Control	90	100	89	99
	90	250	52	58
	90	400	22	24

TABLE 10

KNOWN DISTANCE ACCURACY
Automatic Fire (Night)
(10-round Shot Group)
(Totals of 9 firers)

Type Weapon	Total Rounds Fired	Range (Meters)	Target Hits	Percentage of Hits
Test	90	100	69	77
	90	250	35	39
	90	400	21	23
Control	90	100	67	74
	90	250	35	39
	90	400	5	6

2.5.4 Analysis

2.5.4.1 In terms of mean radius and extreme spreads, the control weapon demonstrates significantly better accuracy than the test weapon. There is, however, no significant difference between the test and control weapons as to hit capability against man-size targets.

2.5.4.2 The test item does not significantly affect the accuracy of the rifle against man-size targets.

2.6 SUBTEST NO 5, QUICK FIRE

2.6.1 Objective

To determine the effectiveness of the test weapon in the quick-fire role.

2.6.2 Method

2.6.2.1 Test soldiers were trained in quick-fire techniques and fired a familiarization quick-fire exercise with the test and control weapons.

2.6.2.2 Fifteen test soldiers each fired the test and control weapons through a quick-fire course, at short-exposure time (pop-up) targets located 20, 40, and 80 meters from the firing point (one target at each range). Targets were randomly presented; exposure time was 4 seconds per target; the firer was not limited in the amount of ammunition to be fired; however, firing was permitted only when targets were presented. Each target was presented twice during each firing exercise. The course was fired four times; twice in the semiautomatic mode and twice in the automatic mode of fire (2- to 3-round bursts). Rounds fired and targets hit were recorded.

2.6.3 Results

The results of quick fire with the test and control weapons are depicted in Tables 11 and 12. The tables depict the results of two repetitions of quick fire in each mode.

TABLE 11

QUICK FIRE
Semiautomatic Fire
(4-second exposure)

Type Weapon	*Number of Targets Presented	Range (Meters)	Targets Hit
Test	58	20	45
	58	40	43
	58	80	42
Control	58	20	47
	58	40	52
	58	80	44

*One of each type weapon (test and control) was withdrawn after the first firing of the exercise.

TABLE 12

QUICK FIRE
Automatic Fire
(4-second exposure)

Type Weapon	*Number of Targets Presented	Range (Meters)	Targets Hit
Test	58	20	54
	58	40	57
	58	80	50
Control	58	20	56
	58	40	54
	58	80	47

*One of each type weapon (test and control) was withdrawn after the first firing of the exercise.

2.6.4 Analysis

There is no significant difference between the performance of the test and control weapons when employed in a quick-fire role.

2.7 SUBTEST NO 6, DURABILITY AND RELIABILITY

2.7.1 Objective

To determine and compare the durability and reliability of the test and control weapons.

2.7.2 Method

2.7.2.1 During the conduct of all subtests incidents pertaining to the durability and reliability of the test weapons were noted. Results were analyzed and recorded under this subtest.

2.7.2.2 In addition to the firing conducted in other subtests, the following exercises were conducted to evaluate the durability and reliability of the test weapon:

a. Thirty test soldiers, 15 armed with the test weapon, and 15 armed with the control weapon, conducted a 4-day exercise as described in figure 19, Appendix I.

b. Five each test and control weapons were fired at the sustained rate of fire, semiautomatic mode (12-15 rounds per minute) for

3 minutes. The weapons were allowed to cool until they could be handled without discomfort, and the firing was repeated until 1,000 rounds had been expended from each weapon.

c. Five 20-round magazines were fired, automatic mode, as rapidly as possible, through five each test and control weapons. The weapons were allowed to cool for 60 seconds and were then fired at the sustained rate of fire (45-60 rounds per minute), automatic mode, 2- to 3-round bursts for 60 seconds. The weapons were allowed to cool until they could be handled without discomfort, and the firing was repeated until 1,000 rounds had been expended from each weapon.

2.7.2.3 The exercises described in paragraph 2.7.2.2 b and c were fired with straight ball, again with straight tracer ammunition, and repeated using a mix of 4 ball to 1 tracer.

2.7.2.4 Three 20-round magazines of ammunition were fired through three each test and control weapons, at the maximum rate of fire, once each morning and once each afternoon for 7 consecutive days in addition to other firing which was conducted with these weapons. The weapons were not cleaned during this period; however, applications of Lube Oil, Semifluid, Automatic Weapons, MIL-L-46000 A (LSA), were applied as needed. A round was left in the chamber of each weapon at the conclusion of each day's firing. The weapons were kept in open, exposed storage throughout the 7-day period.

2.7.2.5 Three each test and control weapons were stored for 9 consecutive days in a climatic chamber maintained at 100°F temperature and 68 to 70-percent humidity. Three hundred rounds of ammunition were fired through each of the six weapons each day for the first 3 days. The weapons were then stored in the climatic chamber for 2 consecutive days without firing. During each of the last 4 days 300 rounds were fired through each weapon. The weapons were fired in both the semiautomatic and automatic modes. The weapons were not cleaned during this period, no additional LSA was applied, a round was left in the chamber, and an uncharged magazine was left in the weapon at the conclusion of each day's firing and during storage.

2.7.2.6 During the conduct of the above exercises any effect of firing on the test and control weapons was noted and compared. A visual inspection of each test and control weapon was made during each cooling period, and a complete technical inspection of each test and control weapon was made upon completion of the firing.

2.7.2.7 A minimum of 6,000 rounds was fired through two test and control weapons. The firing was conducted in various modes (automatic and semiautomatic). Rounds fired during all subtests were counted in this total.

2.7.2.8 A comparison was made of the malfunction rates of the test and control weapons.

2.7.3 Results

2.7.3.1 The results of firing 3,000 rounds through five each test and control weapons as described in paragraphs 2.7.2.2b and c, and 2.7.2.3 are depicted in Table 13 and 14.

TABLE 13

RELIABILITY FIRING, SEMIAUTOMATIC FIRE

	Test Weapon			Control Weapon		
Malfunction	Ball	Tracer	4-1 Mix	Ball	Tracer	4-1 Mix
Failure to Feed	1	4	1	0	1	1
Double-feed	1	2	2	4	1	0
Failure to Eject	0	0	3	0	0	0
Failure of Bolt to Close	0	1	0	0	1	0
Total Rounds Fired	5,000	5,000	5,000	5,000	5,000	5,000

TABLE 14

RELIABILITY FIRING, AUTOMATIC FIRE

	Test Weapon			Control Weapon		
Malfunction	Ball	Tracer	4-1 Mix	Ball	Tracer	4-1 Mix
Failure to Feed	4	1	0	1	0	0
Double-feed	37	58	33	0	3	5
Failure to Eject	0	0	2	0	0	0
Failure of Bolt to Close	3	1	0	0	1	0
Total Rounds Fired	5,000	5,000	5,000	5,000	5,000	5,000

2.7.3.2 Only one malfunction was experienced with the three each test and control weapons during the 7-day firing, open, exposed storage exercise described in paragraph 2.7.2.4. A test weapon experienced a double-feed on the second day of the exercise. All weapons (test and

control) were sluggish in operation on the sixth and seventh days, but no other malfunctions were experienced.

2.7.3.3 No malfunctions were experienced with the three each test and control weapons during the first 5 days of the 9-day firing, climatic chamber exercise described in paragraph 2.7.2.5 On the sixth day the test weapons were sluggish in operation. This condition was not noticeable with the control weapons. On the seventh day of the exercise all weapons (test and control) exhibited sluggish operation. This condition continued throughout the last day of the exercise. On the eighth day of the exercise the test weapons had three malfunctions (two double-feed, one failure of bolt to remain to the rear); the control weapon had one malfunction (double-feed). On the ninth day the carbon build-up in the test and control weapons necessitated the use of the bolt assist on every round fired.

2.7.3.4 The results of firing a minimum of 6,000 rounds through two each test and control weapons are as follows:

Weapon	Number of Malfunctions
Test	5
Control	8

2.7.3.5 The 15 test weapons (test weapon with bent barrel, withdrawn from test, included) fired a cumulative total of 55,769 rounds of ammunition as follows:

5.56-mm Ball (ball propellant) - 43,681

5.56-mm Tracer (IMR propellant) - 12,088

2.7.3.6 The 15 control weapons fired a cumulative total of 53,073 rounds of ammunition as follows:

5.56-mm Ball (ball propellant) - 40,985

5.56-mm Tracer (IMR propellant) - 12,088

2.7.3.7 Total malfunctions occurring during conduct of all subtests pertaining to the durability and reliability of the test and control weapons are depicted in Table 15.

2.7.3.8 Throughout all firing, no broken parts were noted, although the test item mounting screws were loosened during firing and required periodic checking and tightening.

TABLE 15

MALFUNCTIONS

Malfunction	Test Weapon	Control Weapon
Failure to Feed	11	3
Double Feed	140	17
Failure to Eject	6	2
*Failure of Bolt to Close	8	3
Failure of Bolt to Stay to Rear	8	0

*Does not include continuous use of bolt assist on test and control weapons on last day of 9-day firing exercise (para 2.7.3.3).

2.7.4 Analysis

2.7.4.1 The malfunction rate of the test weapon is significantly higher than that of the control weapon. The greatest difference is in the double-feed malfunction rate, 140 for the test weapon, compared with 17 for the control weapon.

2.7.4.2 More malfunctions are experienced by the test weapons during automatic firing. The malfunction rate for the control weapon is relatively the same, regardless of the type fire. The high malfunction rate of the test weapon during automatic fire is considered a shortcoming.

2.7.4.3 The test weapons are durable.

2.8 SUBTEST NO 7, PORTABILITY AND AERIAL DELIVERY

2.8.1 Objectives

2.8.1.1 To determine the ease of carrying the test weapon in field exercises and cross-country.

2.8.1.2 To determine the portability of the test weapon and the ability of the test weapon to withstand aerial delivery by the individual parachutist.

2.8.2 Method

2.8.2.1 Sixteen combat-equipped test soldiers, eight carrying test weapons and eight carrying control weapons, all with fully charged magazines inserted, moved 3 miles through dense brush and 3 miles over open, rough terrain, to include fording streams and crawling through sand. The weapons had been previously zeroed. Periodically during this exercise the test soldiers were required to run, jump, and assume an appropriate position for firing. Upon completion of the exercise, the test and control weapons were inspected for damage, and were fired with the magazine(s) which accompanied the weapons to confirm the previously obtained zero setting.

2.8.2.2 After being zeroed, five each of the test and control weapons were placed, unrestrained, in the cargo compartment of a 1¼-ton truck and transported 25 miles over umimproved roads and cross-country. The weapons were then inspected for damage, function fired, and the previously obtained zero confirmed.

2.8.2.3 After zeroing, one control weapon and four test weapons were attached to individual parachutists and jumped from a UH-1D helicopter. The weapons were slung over the left shoulder of the parachutists, muzzle down, and secured with tie-downs at the shoulder, thigh and calf (fig 15 and 16, app II). After being subjected to the parachute jump the weapons were inspected for damage, and the previously obtained zeroes confirmed.

2.8.2.4 After zeroing, 12 test weapons were subjected to a parachute jump by individual parachutists from a C-119 aircraft. Four of the weapons were carried in the manner described in paragraph 2.8.2.3 and eight were carried by the individual parachutists in the individual weapons container. After being subjected to the parachute jump, the weapons were inspected for damage, and the previously obtained zeroes confirmed.

2.8.3 Results

2.8.3.1 During the march, test soldiers did not experience difficulty with the test weapon being caught on brush, vines, or low hanging limbs.

2.8.3.2 The test item changed the center of balance of the M16A1 rifle, making it awkward to carry by the carrying handle. When carried or handled in any other manner, no appreciable difference was noted in portability between the test and control weapons, other than the added weight. (Fig 17 and 18, app II)

2.8.3.3 No damage was sustained by the test and control weapons as a result of being transported 25 miles cross-country in an unrestrained manner in the cargo compartment of a 1¼-ton truck. The previously obtained zero setting of the test and control weapons was not adversely affected.

2.8.3.4 The results of aerial delivery of the test and control weapons by individual parachutists are as follows:

a. The weapons (test and control) had to be elevated by the parachutists prior to exiting the aircraft in order for the front sight assembly of the weapon to clear the floor of the helicopter (fig 16, app II).

b. Six parachutists attempted to execute left parachute landing falls. Two of the parachutists experienced discomfort when they landed on the weapon and one parachutist had his test weapon torn loose from the tie-downs when he hit the ground. The barrel of a test weapon, carried by a fourth parachutist, hit the ground with sufficient force to bend the barrel approximately 6½ inches from the muzzle end of the weapon. The angle of bend was approximately 35^{o} or 62.3 mils to the left (fig 19, app II). The test weapons in individual weapons containers incurred no damage. Two clicks of elevation were required to confirm the zero of the test weapon that was torn loose during landing. The zero of the test weapon with the bent barrel could not be confirmed. The zeroes of the other test and control weapons were not changed.

2.8.4 Analysis

2.8.4.1 The man-portability of the M16A1 rifle is degraded when the test item is attached because of the additional weight and the change in the center of balance of the weapon.

2.8.4.2 The individual weapons container is needed to protect the test weapon against damage when jumped by the individual parachutist.

2.9 SUBTEST NO 8, MAINTENANCE

2.9.1 Objective

To determine and compare the maintainability of the test and control weapons with respect to ease of maintenance, assembly and disassembly, and adequacy of maintenance instructions, cleaning equipment, and tools provided as basic issue items.

2.9.2 Method

2.9.2.1 Six test weapons were maintained in accordance with instructions contained in the IOMM for the Noise Suppressor, and six test weapons were maintained in accordance with instructions contained in TM 9-1005-249-14. Though not so specified in the publications referenced above, care and cleaning with the test weapon was conducted twice daily for those weapons maintained in accordance with the IOMM

and once daily for those maintained in accordance with TM 9-1005-249-14.

2.9.2.2 All control weapons were maintained in accordance with TM 9-1005-249-14.

2.9.3 Results

2.9.3.1 The six test weapons maintained in accordance with the IOMM (cleaned twice daily) fired a cumulative total of 23,424 rounds. A total of 31 malfunctions was sustained. Twenty-one of the 31 malfunctions were double-feed. These weapons required approximately 135 minutes per day for maintenance.

2.9.3.2 The six test weapons maintained in accordance with TM 9-1005-249-14 (cleaned once daily) fired a cumulative total of 24,047 rounds. A total of 88 malfunctions was sustained. Seventy-seven of the 88 malfunctions were double-feed. Five of these test weapons fired the automatic fire durability test described in paragraph 2.7.2.2c, Subtest No 6, and the majority of the malfunctions noted above were sustained during this automatic fire exercise. These weapons required approximately 90 minutes per day for maintenance.

2.9.3.3 No special tools or equipment were required for the performance of operator maintenance.

2.9.3.4 All mounting screws on the test items attached to the M16A1 rifle required periodic checking and tightening by direct support personnel. One of these mounting screws became loose, and was subsequently lost, during firing and had to be replaced (fig 20, app II). The test item mounting screws required a special size Allen wrench. An alignment gage was also required to periodically check the proper alignment of the test item to the bore of the weapon. No other repairs or replacement of parts were necessary during the conduct of the test.

2.9.3.5 Carbon build-up was greater in the test weapons than in the control weapons. This carbon build-up was particularly noticeable in the lower receiver group, bolt and bolt carrier of the test weapons.

2.9.4 Analysis

2.9.4.1 The test weapons require more frequent and careful cleaning than the control weapons. Periodic inspections are also necessary to check the tightness of the test item mounting screws and proper alignment of the test item with the bore of the weapon.

2.9.4.2 The assembly and disassembly of the test weapon are the same as for the control weapon; the maintenance instructions, cleaning equipment and tools provided as basic issue items with the test and control weapons are adequate.

2.10 SUBTEST NO 9, HUMAN FACTORS ENGINEERING

2.10.1 Objective

To determine if the test weapon was suitably engineered from a human factors standpoint.

2.10.2 Method

Throughout all testing, observations were made to determine the compatability of the test weapons with the skills, aptitudes, and limitations of the soldiers who operated and maintained them. Particular attention was given to the comparative ease of carrying and handling the test and control weapons and any adverse effect on the firer caused by heat, flash, noise, escaping gases, and recoil.

2.10.3 Results

The results of all subtests revealed certain features of the test weapon which were not compatible with the skills, aptitudes and limitations of the soldiers who operated and maintained them. These features were as follows:

a. The test item changed the center of balance of the test weapon making it awkward to carry by the carrying handle (Subtest No 7).

b. The gas deflector on the test weapon did not deflect all of the escaping gas from the firer's eyes, causing some discomfort during automatic and sustained semiautomatic fire (Subtests No 2 and 6).

c. The ejection pattern of the test weapon caused the expended cartridge to strike the right cheek of left-handed firers (Subtest No 2).

d. The configuration of the test weapon makes it extremely difficult to jump, without incurring damage to the weapon, or injury to the jumper, unless the individual weapons container is used.

2.10.4 Analysis

The test weapon is not suitably engineered for left-handed firers, nor with respect to escaping gases. These are previously reported shortcomings.

2.11 SUBTEST NO 10, VALUE ANALYSIS

2.11.1 Objective

To determine if the test weapon contained any unnecessary or costly features which could be eliminated without sacrificing essential quality, reliability, maintainability, performance or mission accomplishment.

2.11.2 Method

During all testing, special attention was given to identification of nonessential or nice-to-have accessories, components, or features, and items which appeared to warrant further study by the developer.

2.11.3 Results

The test weapon did not contain any unnecessary or costly features.

2.11.4 Analysis

The test weapon does not contain any features which are considered unnecessary or costly.

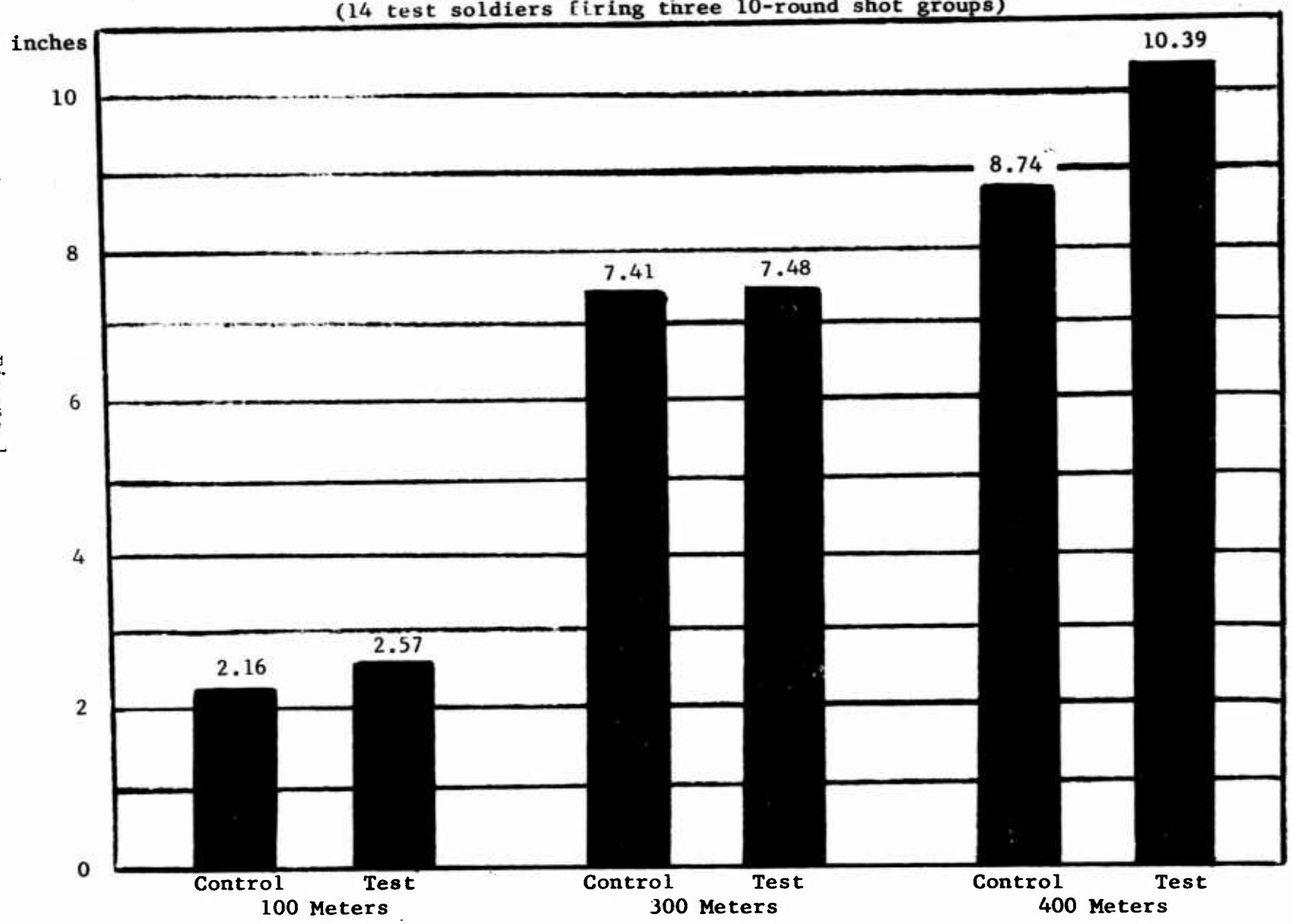
SECTION 3. APPENDICES

APPENDIX I. TEST DATA

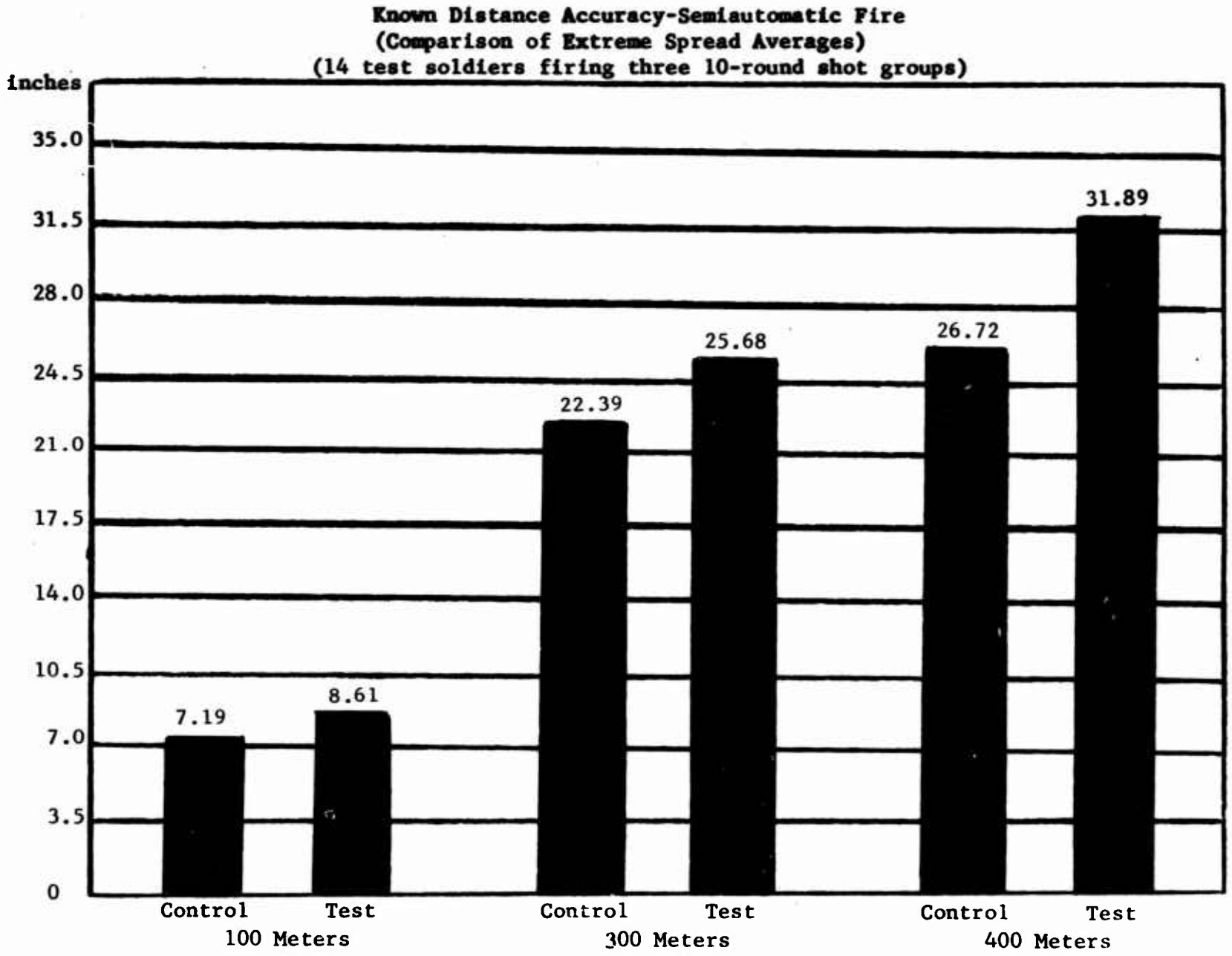
Figure 1

App I

Known Distance Accuracy-Semiautomatic Fire
(Comparison of Mean Radius Averages)
(14 test soldiers firing three 10-round shot groups)



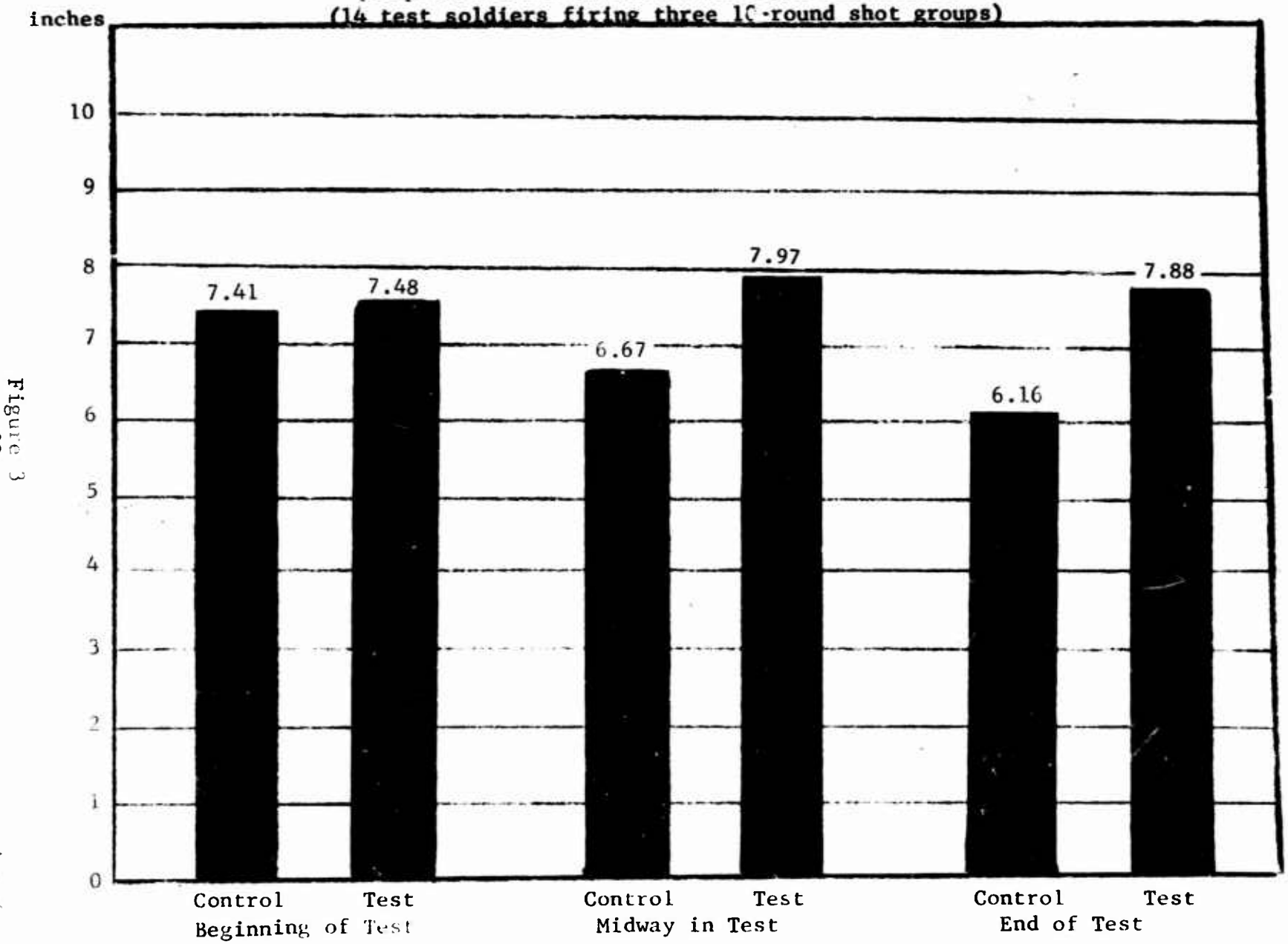
Note: Does not include Test and Control Weapons No 13.



Note: Does not include Test and Control Weapons No 13.

Figure 2

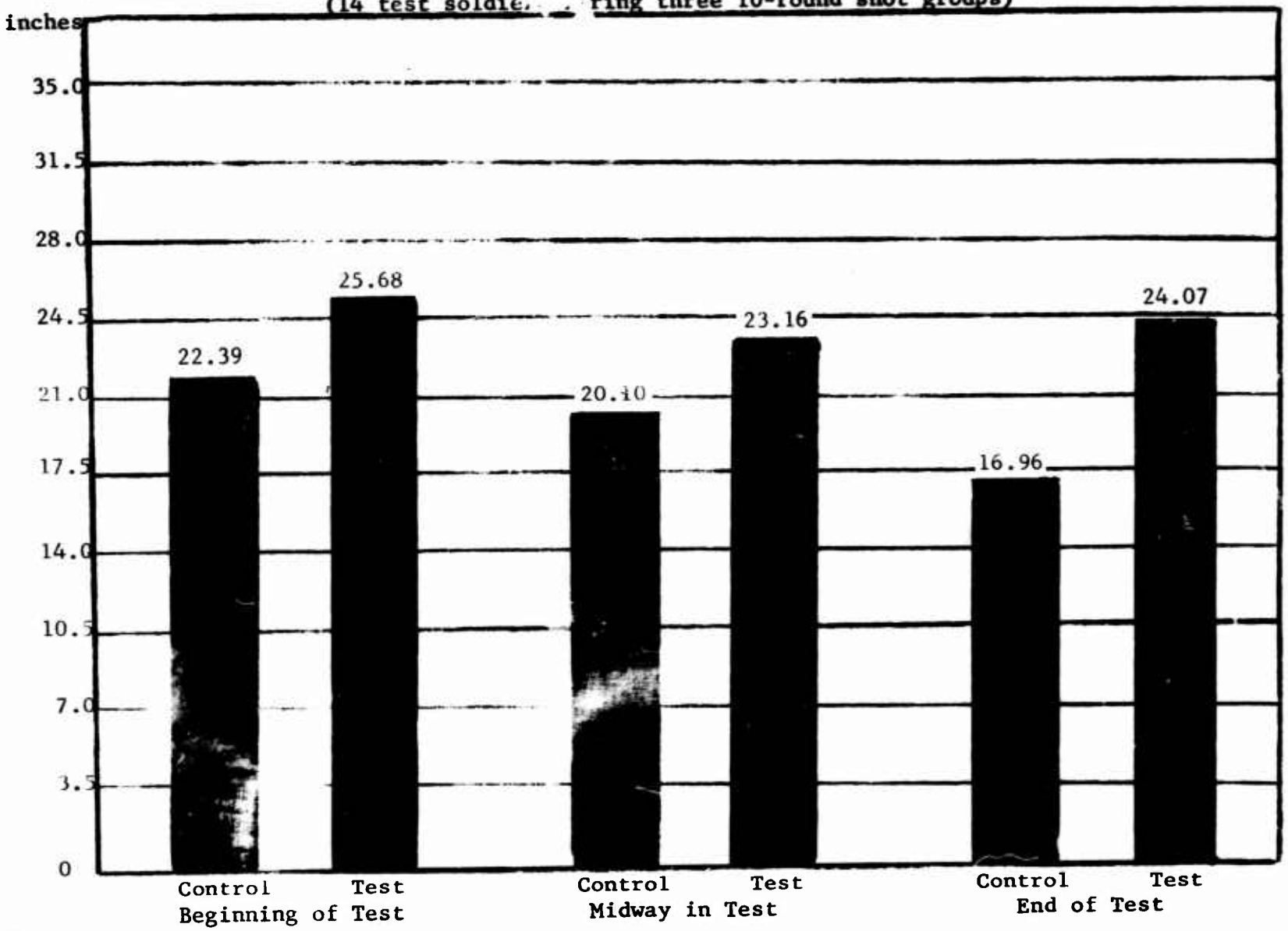
Known Distance Accuracy-Semiautomatic Fire
(Comparison of Mean Radius Averages-300 meters)
(14 test soldiers firing three 10-round shot groups)



Note: Does not include Test and Control Weapons No 13.

Figure 3
28

Known Distance Accuracy-Semiautomatic Fire
(Comparison of Extreme Spread Averages-300 meters)
(14 test soldiers firing three 10-round shot groups)



Note: Does not include Test and Control Weapons No 13.

Figure 4
29

App I

Figure 5

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
100-METER RANGE (Test Weapon)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread
1	10	-1.53	-4.30	1.41	5.00	10	- .73	-2.97	1.50	4.0	10	- .02	-2.73	1.48	4.25
2	10	-5.33	1.28	1.90	6.25	10	2.74	-2.59	2.49	8.5	10	2.09	-2.14	1.39	4.50
3	10	5.9	-3.02	2.03	5.5	10	6.24	-1.13	3.90	16.88	10	4.48	-1.93	2.89	13.00
4	10	-2.4	- .85	2.41	10.0	10	-2.65	- .05	2.27	6.75	10	-3.28	2.85	1.72	10.00
5	10	1.82	-4.76	4.15	13.5	10	1.43	-4.83	5.14	16.00	10	.9	-2.45	2.69	8.5
6	10	.29	.48	2.20	9.5	10	1.25	2.87	1.92	10.13	10	.11	5.8	2.04	6.75
7	10	2.30	- .6	1.93	5.0	10	-1.08	.55	2.82	8.5	10	.55	2.93	4.74	9.25
8	10	-3.16	.84	1.62	6.5	10	1.88	1.89	1.48	6.0	10	1.70	2.57	1.92	6.50
9	10	.68	2.03	2.55	7.0	9	.11	3.28	3.43	8.0	10	.3	5.75	2.12	7.0
10	10	- .7	3.83	3.12	14.5	10	4.03	6.43	3.98	12.5	10	2.58	6.85	4.76	16.25
11	10	.6	-4.14	2.10	6.88	10	-1.51	-4.48	2.24	9.25	10	- .56	-2.85	2.40	6.38
12	10	1.88	.51	1.55	6.15	10	-1.83	1.05	1.91	5.75	10	.53	.67	2.26	7.00
13	10	1.41	-3.3	4.16	15.63	10	4.72	-4.3	3.51	9.25	10	5.06	-1.94	3.89	13.00
14	9	-1.72	3.28	1.03	3.25	9	-1.39	.06	2.12	6.75	10	-1.68	1.10	3.32	7.00
15	10	-1.75	1.35	2.98	10.25	10	-1.85	-1.4	2.53	8.00	10	-1.15	1.33	1.77	6.25

Figure 6

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
100-METER RANGE (Control Weapon)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext Spread
1	10	.70	-3.10	1.81	6.38	10	.05	-3.78	2.70	10.0	10	-1.13	-3.48	1.71	5.75
2	10	2.8	-3.44	1.44	5.50	10	3.35	-4.60	1.70	5.13	10	4.88	-6.58	1.33	5.00
3	10	1.08	4.98	2.47	8.25	10	2.15	4.86	2.55	7.25	10	1.10	5.24	2.53	9.00
4	10	-1.78	- .40	1.90	6.50	9	-1.06	2.39	1.38	5.50	10	- .30	- .70	2.84	7.50
5	10	-1.03	-2.48	1.67	5.50	10	- .15	1.68	2.42	6.50	10	.60	1.40	1.85	6.25
6	10	.16	1.80	1.61	5.13	10	- .69	- .01	1.23	4.00	10	.85	.40	1.67	7.00
7	10	- .33	-1.36	1.95	7.00	10	.08	- .88	2.27	7.75	10	2.30	1.73	1.84	6.50
8	10	- .55	4.74	2.66	9.50	9	.13	2.18	3.31	11.75	9	1.18	2.88	1.48	4.00
9	10	-1.7	-1.25	1.46	5.00	10	- .2	- .25	2.19	6.50	10	.025	4.58	1.87	6.75
10	10	-2.98	7.30	3.40	11.00	10	- .55	4.08	3.53	15.50	10	2.58	2.75	3.73	12.25
11	10	- .18	-3.80	2.04	7.50	10	.59	- .28	1.53	5.88	10	- .08	-1.14	1.91	5.88
12	10	2.33	-2.80	2.03	7.00	10	.93	-4.33	2.55	8.50	10	- .43	-1.38	2.13	6.50
13	10	-2.78	1.90	2.91	11.00	10	1.09	1.91	2.40	7.00	10	-1.11	1.19	2.20	4.00
14	10	-1.43	-2.50	2.17	6.50	10	1.43	-2.23	3.00	10.50	10	-1.98	6.35	1.82	5.75
15	10	-1.38	- .57	2.21	7.50	10	-1.00	-1.60	1.32	4.75	10	-8.30	-1.40	2.34	6.00

Figure 7

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Test Weapon)
(Beginning of Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-1.46	11.79	4.59	16.40	9	-3.59	12.87	4.67	14.63	10	.94	11.90	3.88	13.50
2	10	-.90	6.14	8.06	32.00	9	-4.33	8.47	5.11	19.50	10	-1.24	2.51	5.07	23.25
3	10	25.68	4.59	10.81	33.00	10	7.74	8.88	11.22	38.00	10	15.29	9.3	11.57	42.50
4	10	1.93	16.83	4.37	11.25	10	.95	25.50	5.54	23.50	8	1.06	19.28	10.31	35.00
5	10	3.47	14.85	8.28	27.50	10	-3.75	23.33	7.96	33.50	10	2.30	14.9	6.77	30.00
6	10	3.99	8.79	7.24	26.13	10	7.68	18.31	10.44	35.63	10	4.40	14.38	5.65	12.75
7	9	-5.91	1.57	6.0	16.50	10	-1.91	14.25	6.63	22.00	10	-3.06	8.25	9.92	30.25
8	10	5.05	14.74	9.23	22.50	8	10.11	18.59	12.61	17.00	10	4.07	22.87	6.48	20.00
9	10	-.05	16.53	6.10	20.25	10	6.27	20.97	9.07	25.50	9	-.33	26.61	6.47	20.00
10	10	-9.20	1.80	14.96	52.26	10	6.75	-12.55	15.42	46.50	9	3.86	-17.81	12.76	37.00
11	10	1.89	12.85	3.71	13.50	10	-1.46	10.15	3.32	14.50	10	-2.5	15.74	6.52	28.75
12	9	3.17	-4.76	6.90	22.00	10	-8.7	-.15	7.52	22.50	10	-6.25	-8.33	6.37	23.00
13	deleted from test														
14	10	8.93	3.33	4.99	18.00	10	-2.55	-5.8	6.21	17.50	10	-2.28	-5.1	5.85	18.00
15	10	2.38	1.43	5.25	19.50	10	.58	6.5	5.49	17.00	10	-3.80	7.65	4.71	13.50

Figure 8

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Control Weapon)
(Beginning of Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	1.96	4.11	3.59	10.73	10	3.31	13.60	4.32	14.81	10	2.64	8.86	9.25	12.77
2.	10	10.51	-5.05	7.37	24.00	10	9.53	-6.21	5.80	19.75	10	7.04	-5.73	6.97	21.25
3	10	5.67	12.43	10.13	27.00	10	1.20	11.26	12.35	34.50	10	10.39	7.34	12.49	56.00
4	10	6.50	9.65	9.45	30.00	10	-.47	9.17	5.42	18.00	10	-7.55	16.80	9.31	24.50
5	10	-22.50	-4.00	21.56	26.00	10	.90	8.07	7.81	36.00	10	3.15	9.30	6.82	27.75
6	10	1.54	-5.99	4.92	20.00	10	7.51	-16.59	5.34	19.00	10	5.40	-10.66	6.19	22.00
7	10	6.39	1.49	5.01	14.50	10	.25	8.76	9.69	28.00	10	5.66	1.61	6.43	20.50
8	10	-.68	11.09	9.19	24.00	10	2.06	-1.94	5.08	16.75	10	3.94	6.23	8.93	21.00
9	10	-2.03	-.45	9.08	27.25	9	-6.55	7.86	5.37	15.50	10	-4.27	8.55	6.13	19.00
10	10	8.1	-11.07	7.36	27.00	10	1.45	-5.05	8.20	25.50	10	9.42	.65	9.17	37.00
11	10	1.31	8.34	5.03	15.00	10	-2.51	10.93	3.80	15.13	10	1.38	2.79	3.85	16.13
12	10	4.90	-18.7	6.63	19.00	10	-8.05	-11.75	5.96	22.00	10	.45	-17.35	12.29	21.00
13	deleted from test														
14	10	-1.73	-4.13	5.11	19.50	10	-1.5	.30	8.68	20.25	10	-2.93	.50	5.66	21.25
15	10	8.63	-12.48	4.43	15.00	10	6.88	-8.20	5.08	16.50	10	4.63	-2.05	6.08	19.75

Figure 9

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Test Weapon)
(Midway in Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-1.05	20.33	7.18	3.05	10	2.65	13.63	7.30	28.00	10	-.78	14.2	5.98	23.25
2	10	1.40	10.55	5.20	16.75	10	2.23	23.13	8.03	18.50	10	-5.64	14.13	8.13	26.50
3	10	6.90	11.13	10.07	41.00	10	1.58	4.18	8.15	30.00	10	2.38	10.85	7.94	27.50
4	10	-.80	2.83	10.87	25.00	10	1.23	17.58	7.95	25.75	10	3.25	20.58	6.75	19.50
5	10	-.73	5.80	5.71	11.00	10	-4.53	8.2	10.72	41.50	10	-4.78	17.88	10.22	28.50
6	10	3.00	14.83	7.3	20.00	10	4.20	10.70	9.89	28.50	10	4.74	19.83	8.52	33.50
7	10	-3.13	8.65	9.81	26.75	10	1.00	23.20	6.37	16.25	10	-1.3	.23	7.91	30.75
8	10	.98	-4.93	11.72	32.25	10	2.25	11.68	7.01	22.25	10	6.58	20.50	8.14	25.50
9	10	-1.58	18.48	12.24	19.50	10	-3.93	16.65	8.11	24.00	10	-5.28	18.93	9.07	16.75
10	10	8.98	13.68	7.44	21.50	10	9.63	17.25	9.79	33.50	10	3.11	22.11	8.63	22.75
11	10	.53	16.83	4.16	17.00	10	-2.93	15.05	5.90	11.50	10	-1.50	17.60	5.09	17.00
12	10	-4.68	-10.95	5.31	17.50	10	-4.8	7.58	8.40	16.50	10	-3.15	8.83	5.94	14.75
13	deleted from test														
14	10	9.18	3.30	6.74	30.50	10	7.58	4.40	6.19	18.75	10	2.60	8.38	8.14	18.50
15	10	-9.18	21.15	10.94	7.25	10	-2.90	17.53	9.89	17.75	10	-4.48	15.70	6.09	19.25

Figure 10

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Control Weapon)
(Midway in Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-3.45	14.65	5.90	23.00	10	-2.0	5.60	6.59	18.00	10	-5.4.	10.85	6.28	17.50
2	10	14.58	-3.39	4.46	15.00	10	11.73	4.68	6.27	16.00	10	10.2	1.81	4.08	14.00
3	10	5.73	-.45	6.28	17.50	10	6.55	-2.9	10.45	24.25	10	2.48	-6.8	7.87	25.50
4	10	2.23	-8.68	4.45	15.00	10	3.40	-10.3	5.61	20.50	10	-5.18	-4.70	6.23	21.75
5	10	.58	6.45	4.83	19.25	10	7.25	9.28	6.99	20.50	10	8.05	10.08	7.10	24.00
6	10	6.91	2.98	3.74	9.50	10	8.80	-12.52	4.45	21.00	10	3.60	2.98	6.34	12.00
7	10	7.80	6.32	5.00	21.00	10	12.40	10.02	4.68	12.00	10	11.75	2.65	5.47	15.50
8	10	-3.4	-6.45	15.66	16.00	10	4.92	-9.68	5.66	16.50	10	-2.60	-13.70	8.32	24.50
9	10	-3.28	12.35	6.40	28.00	10	-5.30	17.13	7.37	20.00	10	-9.75	19.23	5.56	20.00
10	10	2.80	1.56	18.81	52.00	10	6.03	-6.58	8.00	24.50	10	-3.23	-1.35	7.85	27.50
11	10	2.65	1.75	9.12	27.75	10	4.4	2.75	4.72	14.50	10	.55	11.23	5.51	17.50
12	10	8.00	0	6.35	22.00	10	6.90	-2.70	6.50	17.50	10	3.1	-.55	6.49	22.00
13	deleted from test														
14	10	4.03	6.75	8.96	23.50	10	6.88	14.03	2.79	8.75	10	11.53	11.05	4.59	20.50
15	10	-6.65	16.3	6.51	20.50	10	-5.68	13.3	6.70	18.00	10	-3.88	5.75	5.17	19.75

Figure 11

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Test Weapon)
(End of Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	2.32	6.6	3.64	9.50	10	.58	7.6	5.42	15.75	10	-1.18	12.70	3.32	12.00
2	10	1.43	8.05	8.84	28.25	10	-13.53	11.70	7.22	22.75	10	-1.10	16.48	10.50	41.00
3	10	16.30	1.55	7.51	25.00	10	11.68	-6.58	8.21	24.00	9	15.42	-6.31	12.75	41.00
4	10	4.08	18.35	7.49	23.00	10	1.03	9.18	10.05	26.50	10	8.03	14.08	8.51	25.50
5	10	4.60	-8.11	8.81	28.88	10	2.88	-1.63	8.31	29.50	10	1.58	7.58	7.77	17.00
6	10	.15	6.25	6.06	18.50	10	-4.00	21.43	10.30	30.25	10	-3.63	21.95	5.61	28.5
7	10	-.3	4.15	10.02	39.00	10	-.45	2.3	5.54	11.00	10	.10	13.05	5.01	+21
8	10	20.43	-3.58	10.16	20.00	10	18.03	10.73	5.41	19.00	10	20.45	-2.95	16.35	58.00
9	10	-8	4.13	12.5	25.0	10	-1.43	6.1	6.43	16.5	10	10.00	12.83	4.49	17.00
10	10	.18	18.25	6.5	23.0	10	4.6	19.23	9.42	32.00	10	4.38	20.68	10.94	36.00
11	10	3.38	6.83	5.62	18.50	10	-1.8	6.50	3.27	10.50	10	..18	10.18	5.98	17.50
12	10	-4.15	1.58	13.43	23.00	10	5.4	-13.53	11.08	25.00	10	-7.88	-13.43	6.30	18.00
13	deleted from test														
14	10	-3.23	.9	7.16	23.0	10	-4.48	19.75	6.55	24.0	10	-1	18.98	8.68	25.50
15	10	12.80	16.3	6.1	19.25	10	20.0	24.2	7.53	23.0	10	12.23	21.56	5.98	19.50

Figure 12

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
300-METER RANGE (Control Weapon)
(End of Test)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-2.38	10.96	5.22	19.50	10	-4.33	9.8	5.18	7.0	10	-3.08	16.36	3.21	11.00
2	10	-1.58	3.30	7.39	22.50	10	.05	-8.8	4.68	16.25	10	3.03	-11.83	7.34	21.25
3	10	6.28	-9.33	12.88	17.50	10	5.3	-11.98	10.14	29.00	10	5.43	-21.73	9.01	30.00
4	10	6.23	6.6	4.69	18.00	10	2.38	7.93	4.61	7.50	10	6.35	2.25	5.83	15.25
5	10	1.10	-4.36	8.78	9.75	10	.13	-9.15	5.45	24.00	10	5.55	-10.18	4.77	14.50
6	10	-4.15	5.65	4.37	12.00	10	-7.30	7.43	3.82	11.50	10	-1.4	2.58	5.31	17.50
7	10	-.34	8.2	5.39	16.00	10	1.25	7.08	5.51	19.50	10	2.95	3.95	4.99	13.00
8	9	3.58	13.56	7.06	20.0	10	4.15	3.75	9.65	18.75	10	6.80	11.1	7.73	17.50
9	10	.13	1.03	4.48	16.50	10	-6.69	12.00	4.28	10.00	10	-4.13	9.85	7.62	20.00
10	10	4.93	-.93	5.65	21.0	10	3.38	6.23	5.45	18.50	10	3.33	2.75	7.12	21.00
11	10	-1.01	5.30	5.31	20.00	10	1.10	5.18	5.53	19.00	10	.55	2.85	4.68	12.00
12	10	-3.93	-8.9	14.31	17.00	10	-5.58	-8.53	6.63	19.00	10	-5.28	-3.05	7.10	25.00
13	deleted from test														
14	10	1.73	2.53	5.30	17.0	10	3.88	5.1	2.99	7.00	10	5.18	2.30	5.47	15.00
15	10	6.53	.73	4.52	15.50	10	9.28	-.40	5.03	15.75	10	9.9	-1.09	4.17	9.50

Figure 13

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
400-METER RANGE (Test Weapon)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-5.7	4.04	9.47	25.75	10	-6.45	.61	6.74	20.13	10	1.13	5.56	8.19	24.00
2	10	-4.4	-2.1	12.68	59.00	10	1.15	5.29	7.80	26.75	10	10.13	9.0	8.33	21.25
3	10	6.09	17.19	13.96	42.00	9	15.36	10.36	8.73	24.00	10	11.93	19.33	14.37	54.00
4	10	1.15	-5.25	8.69	33.75	10	1.25	-3.35	11.55	36.00	10	11.10	9.33	13.46	39.00
5	10	3.68	-14.90	10.63	24.50	10	5.48	-13.7	9.35	20.25	10	13.35	-9.55	13.08	29.50
6	10	4.73	9.03	10.27	27.00	10	-9.64	5.88	6.62	27.00	10	4.93	-1.64	12.47	32.63
7	10	4.75	27.05	7.71	25.50	10	-3.62	11.65	15.82	35.00	10	5.35	10.92	7.49	30.25
8	10	6.12	9.48	15.60	42.00	10	-.43	14.35	13.70	42.00	10	8.05	10.45	10.91	38.00
9	9	-1.66	20.86	10.30	25.50	10	-10.38	16.55	13.67	23.50	10	-1.95	15.53	11.08	40.00
10	10	10.20	-2.68	10.78	44.00	10	-.85	-8.75	12.74	38.50	10	17.65	-2.7	14.71	61.00
11	10	3.50	5.90	5.16	28.00	10	-6.43	5.28	6.57	27.00	10	-3.25	8.71	6.73	20.25
12	10	13.05	-12.13	8.98	35.00	10	1.12	7.80	7.93	24.00	10	.08	21.78	9.22	25.00
13	5	-21.9	-12.55	16.79	41.00	9	-9.93	10.53	19.31	65.00	8	-17.72	9.11	12.91	30.25
14	10	18.48	9.40	10.48	37.00	10	20.80	19.35	8.07	28.25	10	16.45	23.00	6.03	23.25
15	10	-5.58	-29.95	6.11	13.00	10	-13.28	-19.18	3.22	12.25	10	-7.55	-25.75	9.36	14.00

Figure 14

KNOWN DISTANCE ACCURACY - SEMIAUTOMATIC FIRE
400-METER RANGE (Control Weapon)
(Measurements in Inches)

Wpn No	First 10-Round Shot Group					Second 10-Round Shot Group					Third 10-Round Shot Group				
	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread	Target Hits	Center of Impact X	Center of Impact Y	Mean Radius	Ext. Spread
1	10	-17.29	-6.94	7.68	23.50	10	-7.64	3.52	5.30	16.25	10	3.74	1.71	7.22	25.88
2	10	-1.53	-23.95	9.99	16.75	10	-4.48	-12.88	6.99	20.00	10	8.38	-9.18	7.08	18.25
3	10	-2.33	3.13	13.18	35.50	10	2.18	12.61	12.48	35.00	10	1.70	12.88	11.86	34.00
4	10	-4.60	-8.85	7.59	25.75	10	-7.58	-16.38	7.73	21.00	10	-9.9	-10.0	6.63	22.00
5	10	-10.75	-5.00	9.84	33.50	10	-3.85	-2.75	9.12	26.00	10	2.85	-4.88	8.34	23.25
6	10	2.76	-11.53	7.41	24.25	9	-.95	-23.1	7.33	27.13	10	-3.59	-27.03	6.46	19.75
7	9	3.83	-23.11	9.33	34.00	11	4.67	-15.53	9.51	31.50	9	2.25	-18.83	5.12	21.00
8	10	3.18	4.33	11.80	35.50	10	7.89	2.73	6.16	21.50	10	7.55	18.42	8.73	28.50
9	9	-8.08	-5.56	7.70	23.00	10	-7.02	-7.38	11.78	31.50	10	-6.28	-6.73	9.39	31.75
10	9	-5.67	-14.92	11.27	29.00	9	-.19	-19.31	11.87	65.00	9	3.80	-16.19	9.86	31.00
11	10	-6.23	14.51	8.59	35.75	10	.03	19.63	7.88	22.00	10	-.54	14.95	8.17	23.5
12	10	2.49	-1.9	8.14	33.75	10	-9.18	11.40	9.12	37.00	10	16.22	..32	9.24	26.00
13	10	1.14	-1.15	9.82	20.50	9	-2.69	-9.36	7.98	11.50	10	-5.05	-10.05	8.62	27.50
14	10	-1.70	-9.60	9.21	27.75	10	.08	-16.23	7.48	18.00	10	.78	-17.68	8.91	30.00
15	10	-16.0	-1.3	9.78	17.25	10	-1.83	-20.83	9.21	20.00	10	4.93	-24.1	6.59	21.00

Known Distance Accuracy-Semiautomatic Fire
Analysis of Variance-Test and Control Weapons
(Dependent variable is mean radius)

Range: 100 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	89	
Weapon	1	3.880*
Trial	2	.595
Wpn X Trial	2	.215
Error	84	.720

Conclusion: Control weapon performance is superior to test weapon performance.

Range: 300 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	83	
Weapon	1	.080
Trial	2	.560
Wpn X Trial	2	8.130
Error	78	10.056

Conclusion: Control weapon performance is equal to test weapon performance.

Range: 400 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	89	
Weapon	1	61.310**
Trial	2	3.523
Wpn X Trial	2	3.486
Error	84	7.760

Conclusion: Control weapon performance is superior to test weapon performance.

*Indicates significance at .05 level.
**Indicates significance at .01 level.

Figure 15

Known Distance Accuracy-Semiautomatic Fire
Analysis of Variance-Test and Control Weapons
(Dependent variable is extreme spread)

Range: 100 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	89	
Weapon	1	44.800*
Trial	2	7.150
Wpn X Trial	2	1.105
Error	84	9.280

Conclusion: Control weapon performance is superior to test weapon performance.

Range: 300 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	83	
Weapon	1	227.140*
Trial	2	18.395
Wpn X Trial	2	49.085
Error	78	48.003

Conclusion: Control weapon performance is superior to test weapon performance.

Range: 400 Meters

Source of Variation	Degrees of Freedom	Mean Square
Total	89	
Weapon	1	600.686*
Trial	2	40.523
Wpn X Trial	2	25.568
Error	84	111.651

Conclusion: Control weapon performance is superior to test weapon performance.

*Indicates significance at .05 level.

Figure 16

Known Distance Accuracy-Semiautomatic Fire
Analysis of Variance
(Dependent variable is mean radius)

(Range 300 Meters)

Control Weapon

Source of Variation	Degrees of Freedom	Mean Square
Total	125	
Time	2	16.708
Trial	2	16.246
Time X Trial	4	2.142
Error	117	8.135

Conclusion: Control weapon performance did not change over time.

Test Weapon

Source of Variation	Degrees of Freedom	Mean Square
Total	125	
Time	2	2.905
Trial	2	.545
Time X Trial	4	2.450
Error	117	7.211

Conclusion: Test weapon performance did not change over time.

Figure 17

Known Distance Accuracy-Semiautomatic Fire
Analysis of Variance
(Dependent variable is extreme spread)

(Range 300 Meters)

Control Weapon

Source of Variation	Degrees of Freedom	Mean Square
Total	125	
Time	2	312.039**
Trial	2	57.799
Time X Trial	4	25.923
Error	117	47.718

Conclusion: Control weapon performance improved over time.

Test Weapon

Source of Variation	Degrees of Freedom	Mean Square
Total	125	
Time	2	68.510
Trial	2	22.710
Time X Trial	4	51.815
Error	117	58.122

Conclusion: Test weapon performance did not change over time.

**Indicates significance at .01 level.

Figure 18

FOUR-DAY OPERATIONAL TEST CYCLE

1st Day

0800-1200	Move to base camp location, set up, brief personnel, issue equipment and defense order.
1200-1800	Prepare defense position.
1800-2400	Issue complete defense and patrol orders. Man defensive positions.

2d Day

0001-0600	Man defensive positions.
0600-0900	Preparation for conduct of patrols.
0900-1500	Conduct of squad size reconnaisance patrols.
1500-1800	Continue work on defensive positions.
1800-2400	Man defensive positions. Issue order for conducting ambush.

3d Day

0001-0600	Man defensive positions.
0600-0900	Preparation for ambush.
0900-1200	Move to ambush location.
1200-1600	Conduct of ambush.
1600-1700	Return to base camp.
1700-2400	Man defensive positions.

4th Day

0001-0600	Man defensive positions.
0600-0800	Motor march to Farnsworth Range.
0800-1600	Known distance (300 meters) accuracy firing. (Para 2.5.2.1, Subtest No 4)

Figure 19

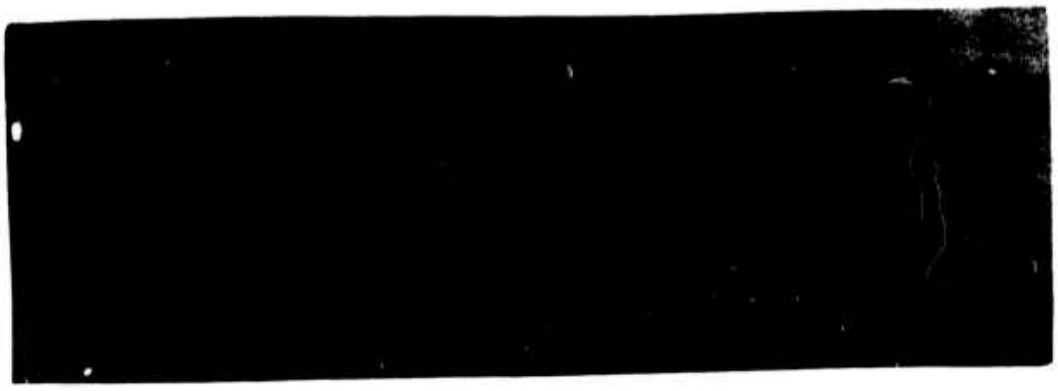


Figure 1

NOISE SUPPRESSOR, HEL, M4

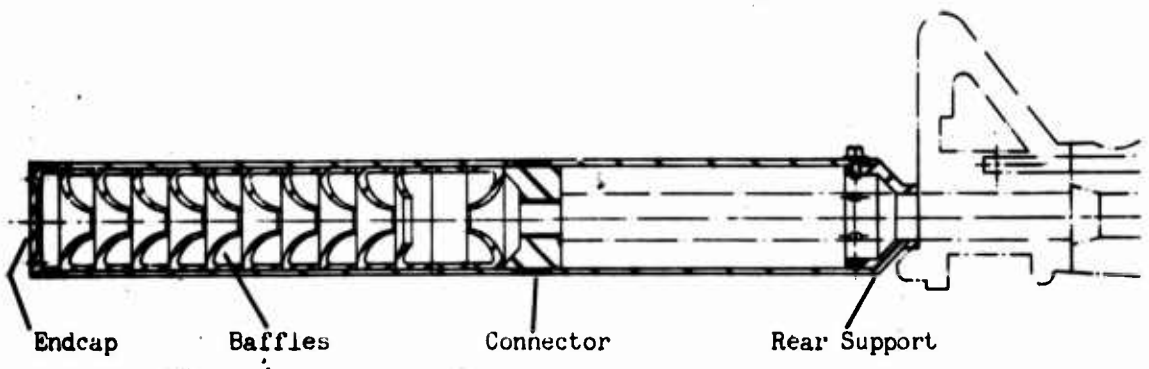


Figure 2

Sketch of Noise Suppressor, HEL, M4
(inside view)

Figure 3

M16A1 Rifle with Noise Suppressor,
HEL, M4, Attached.

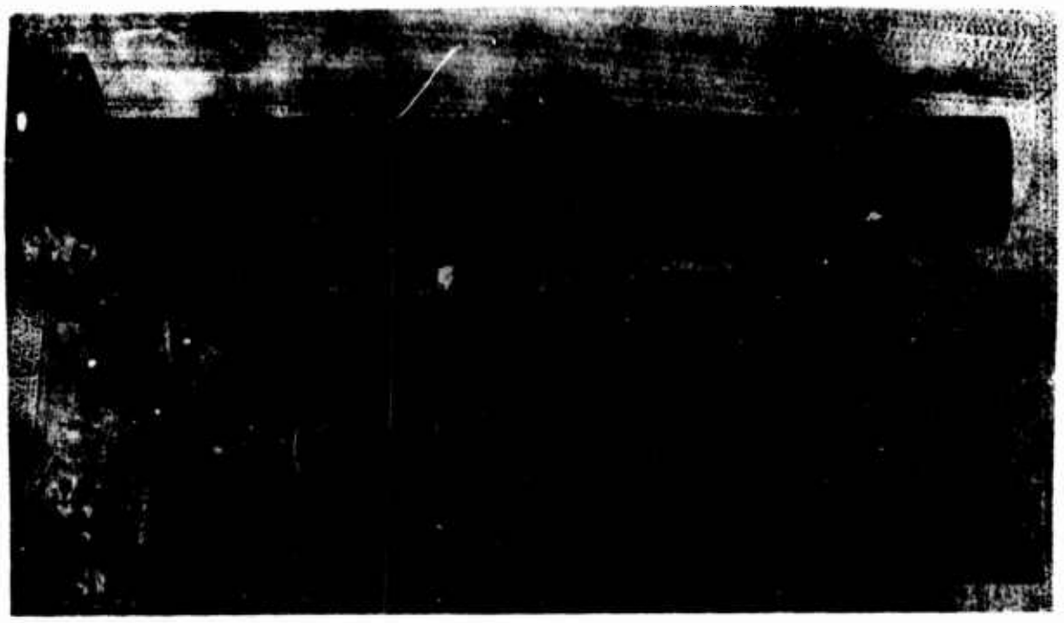


Figure 4

NOISE SUPPRESSOR, HEL, M4,
WITH ACCESSORIES

A. Noise Suppressor, HEL, M4

B. Modified bolt

C. Gas Deflector

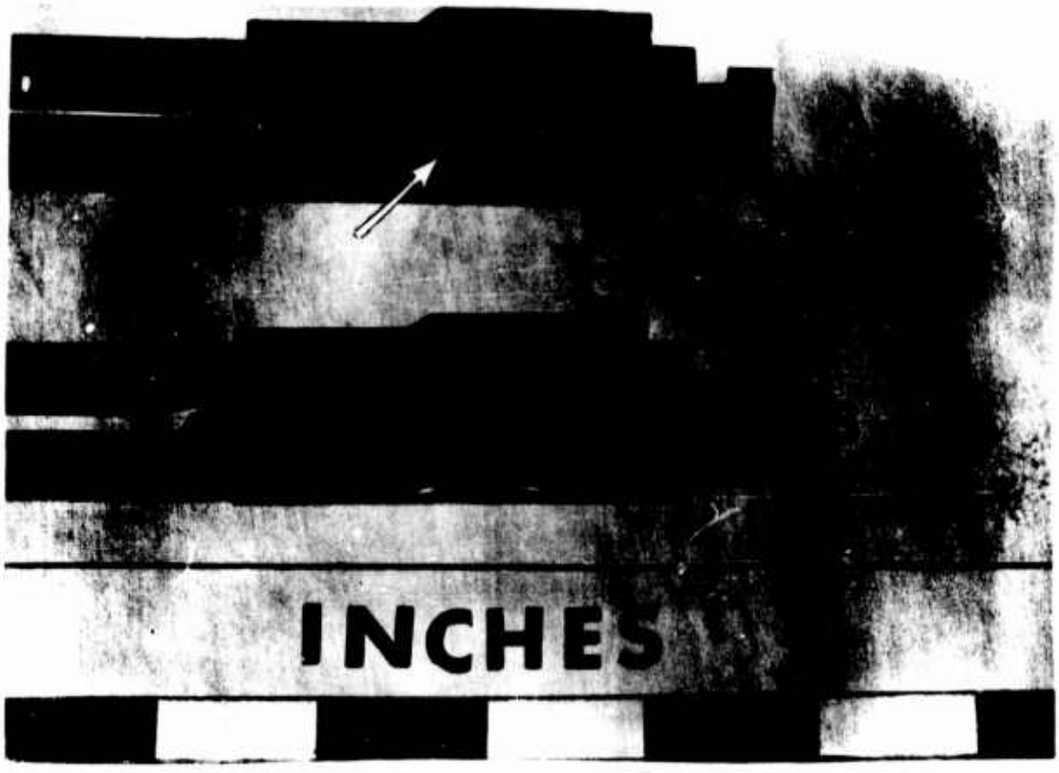


Figure 5

A. Modified Bolt for Use with Noise Suppressor, HEL, M4. (Arrow indicates additional gas pressure relief port.)

B. Standard Bolt for M16A1 Rifle.

Figure 6

A. Gas Deflector Mounted on Charging Handle of M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

B. M16A1 Rifle without Gas Deflector Mounted on Charging Handle.

Figure 7

A. M16A1 Rifle with Noise Suppressor, HEL, M4, Attached, and Magazine Inserted.

B. M16A1 Rifle with Magazine Inserted.

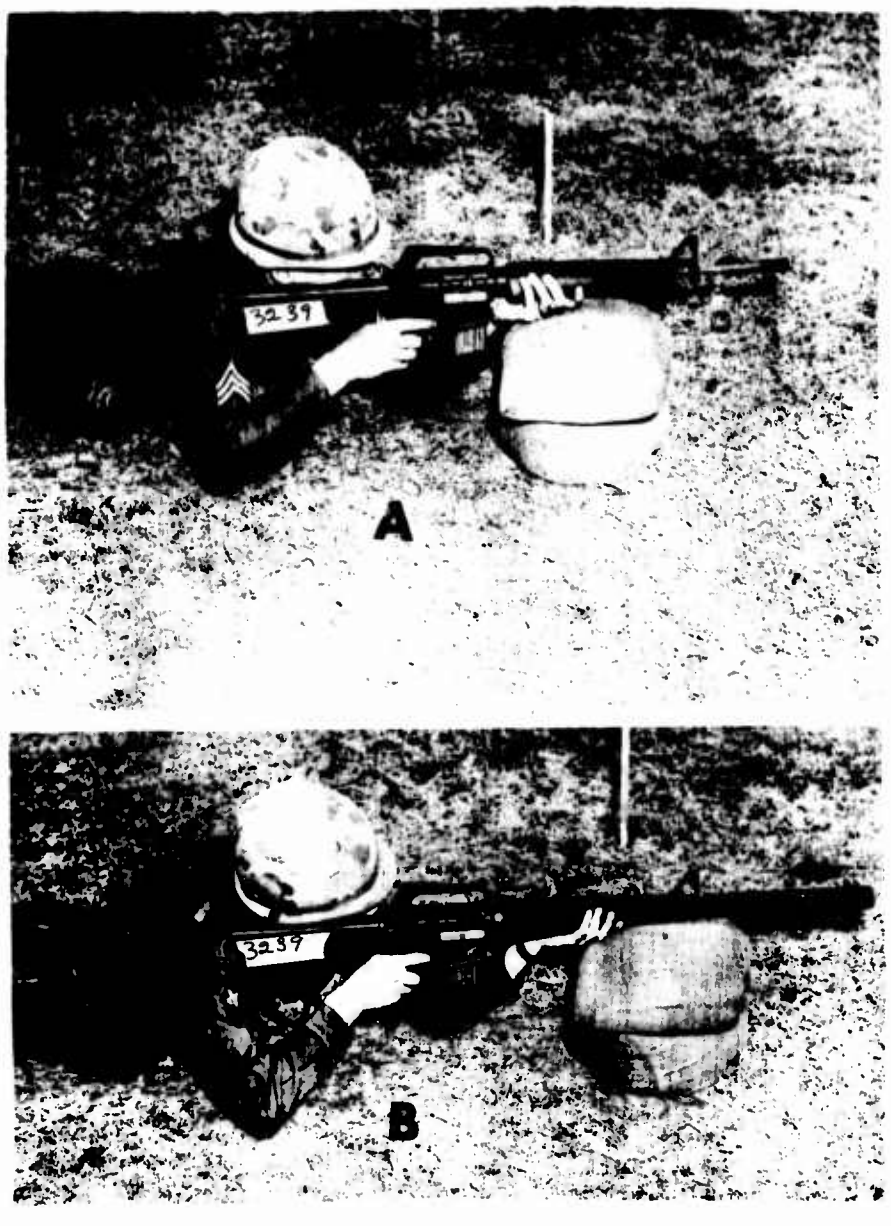


Figure 8

A. Test Soldier Firing M16A1 Rifle.

B. Test Soldier Firing M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

Figure 2

A. Alignment Gage Inserted into Properly Aligned Noise Suppressor, HEL, M4.

B. Alignment Gage Inserted into Noise Suppressor, HEL, M4, on M16A1 Rifle with Defective Barrel.

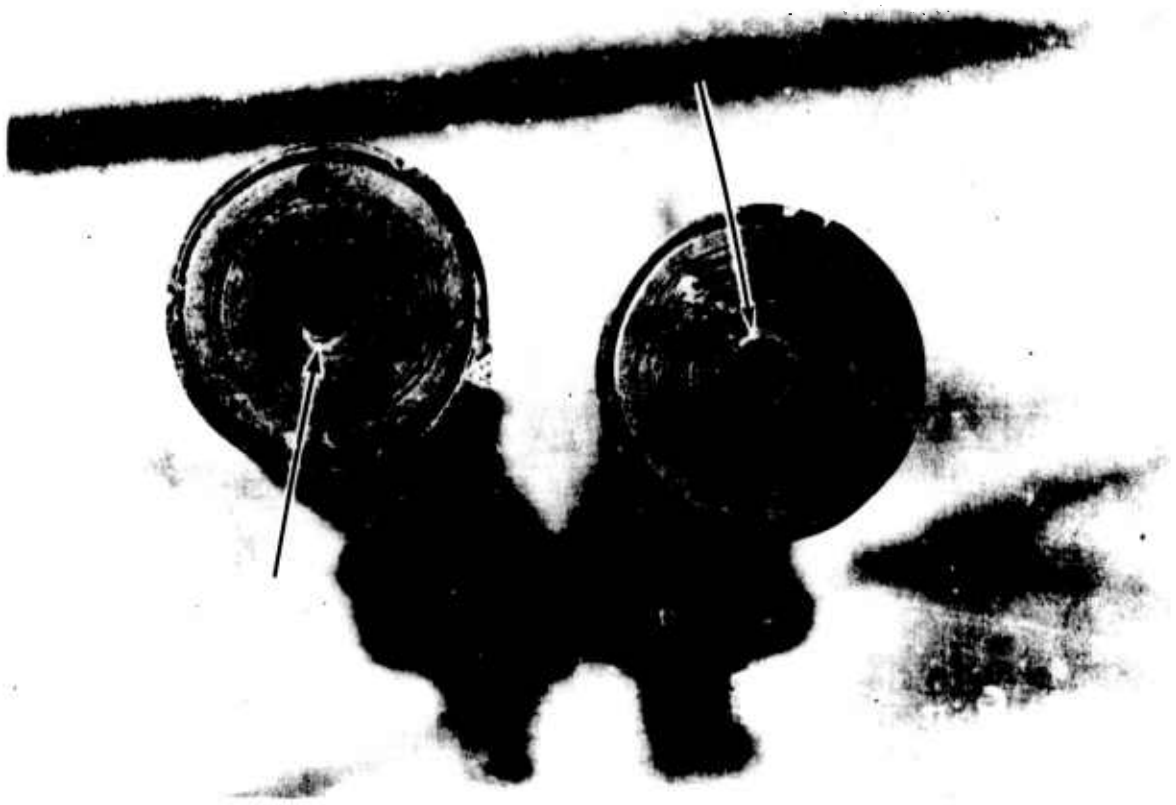


Figure 10

Arrows indicate Peening of Endcap of Noise Suppressor, HEL, M4, by Projectile.

APPROXIMATE EJECTION PATTERN FOR

A. M16A1

B. M16A1 WITH SUPPRESSOR

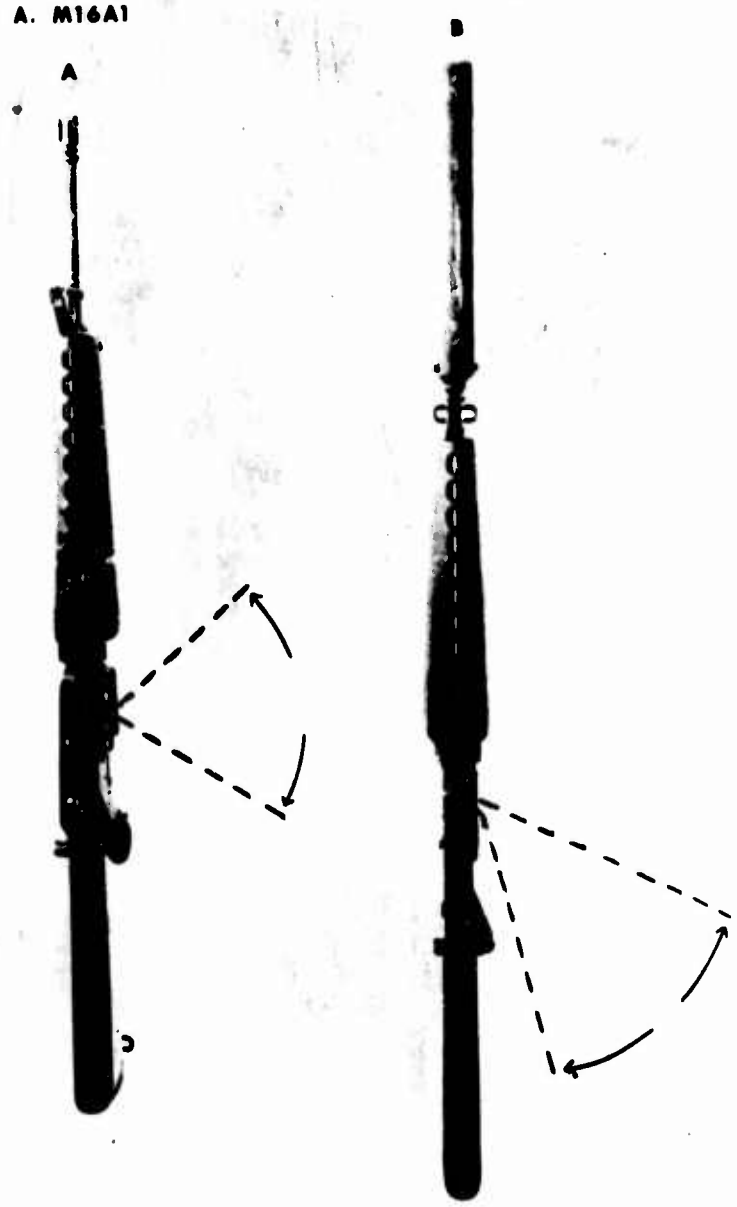


Figure 11

Ejection Pattern of M16A1 Rifle and M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

Figure 12

Circular Cuts on Face of Left-Handed Firer Caused by Ejection of Expended Cartridge from M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

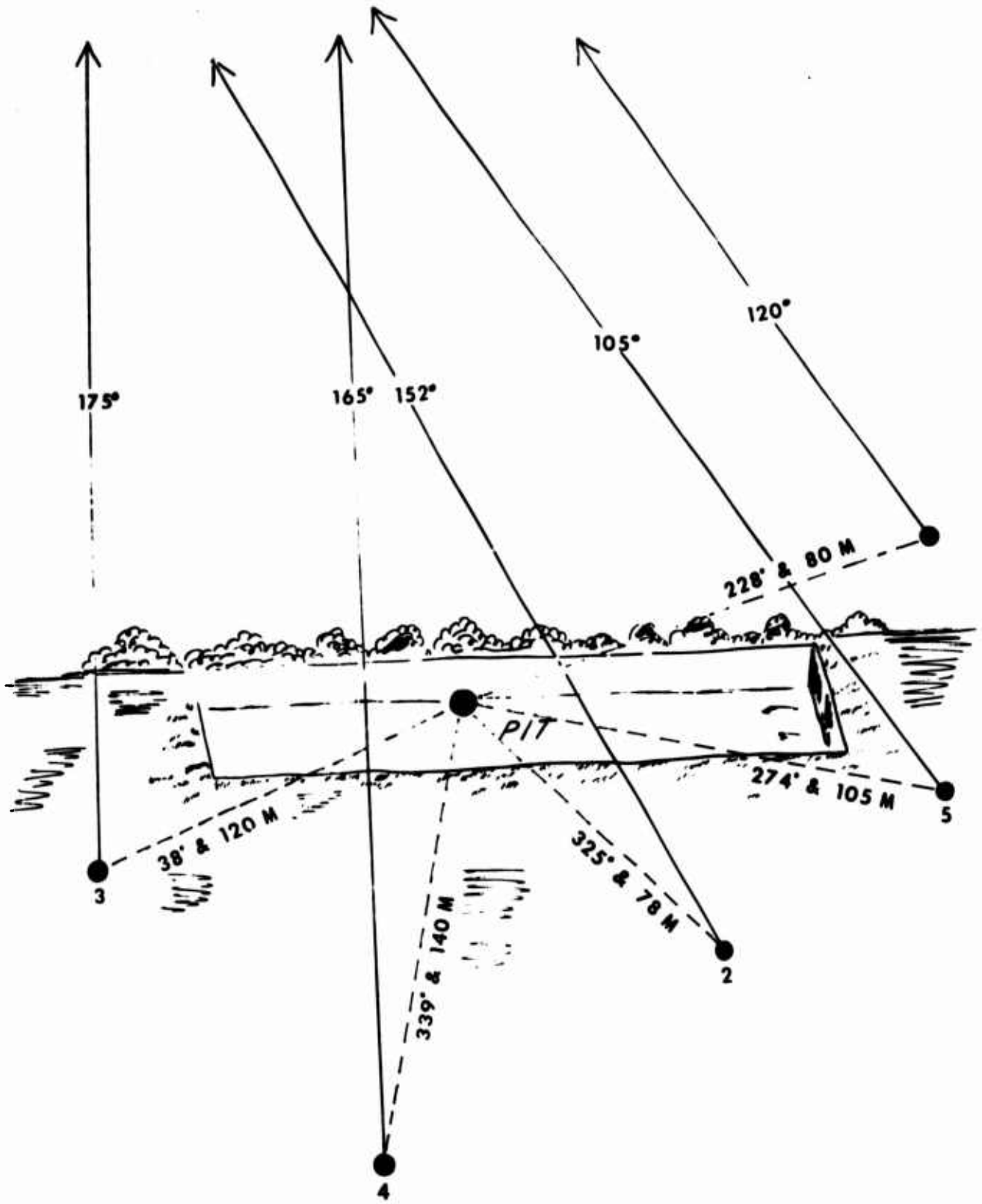


Figure 13

Schematic of Overhead Firing Exercise Used to Test Deceptive Characteristics of M16A1 Rifle with Noise Suppressor, HEL M4, attached.

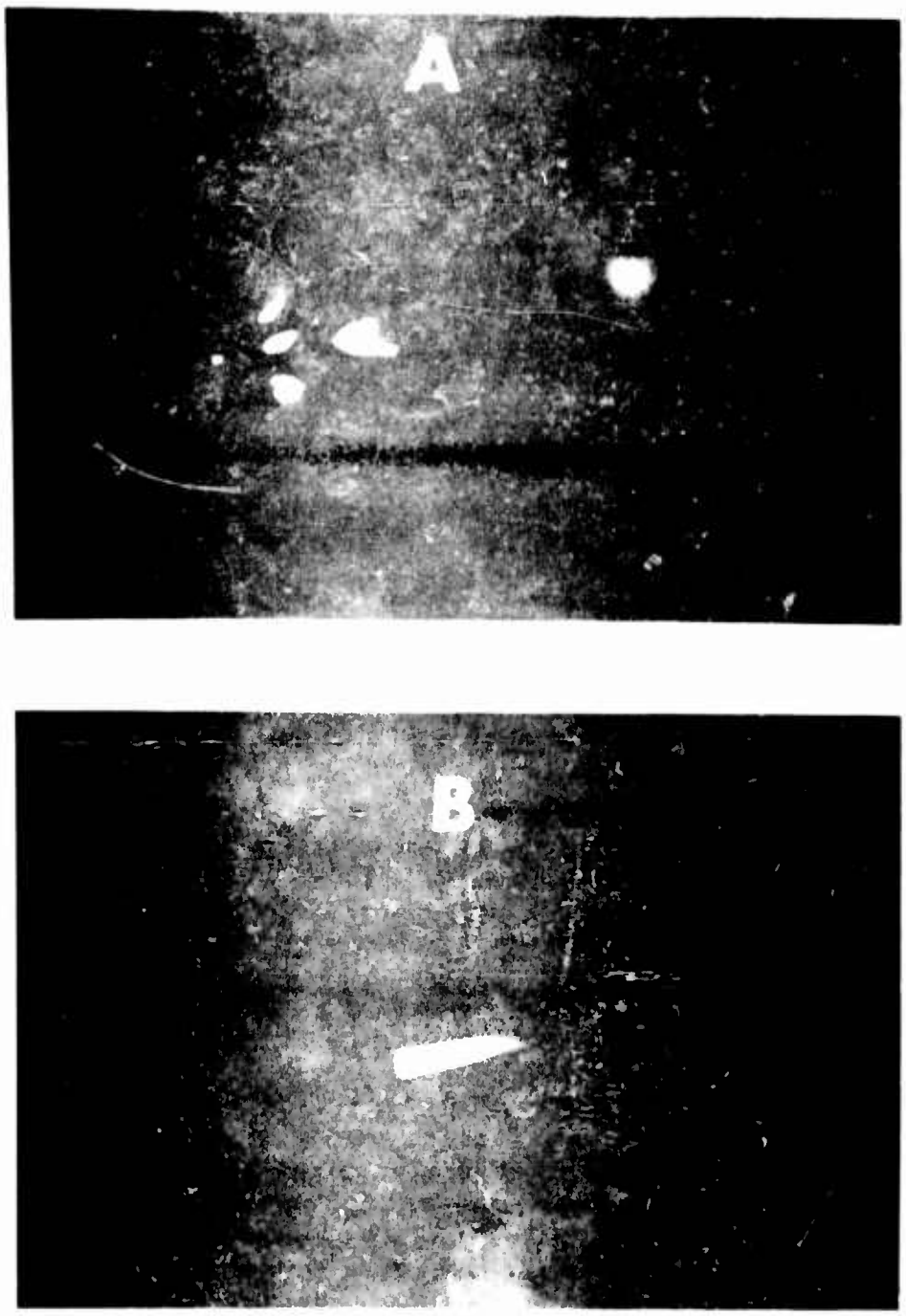


Figure 14

Comparison of Signature Effects (Flash) of Test and Control Weapon (at night).

A. M16A1 Rifle.

B. M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

Figure 15

Parachutist with M16A1 Rifle with
Noise Suppressor, HEL, M4, attached.

Figure 16

Parachutists Preparing to Jump from UH-1D Aircraft

A. M16A1 rifle with front sight assembly caught on floor of aircraft.

B and C. M16A1 rifle with Noise Suppressor, HEL, M4, attached with front sight assembly lifted up over floor of aircraft.

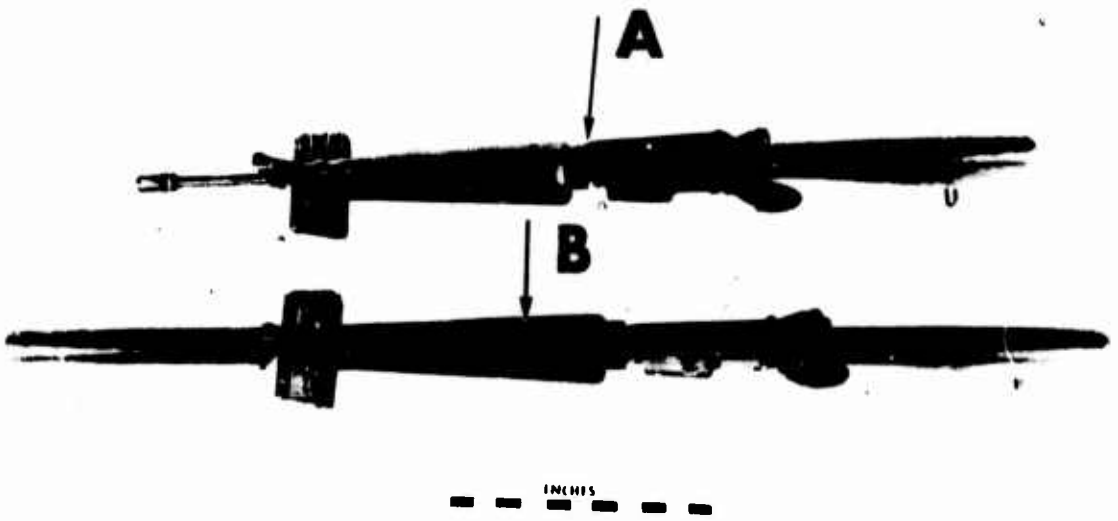


Figure 17

CENTER OF BALANCE

A. Arrow Indicates Center of Balance of Unloaded M16A1 Rifle.

B. Arrow Indicates Center of Balance of Unloaded M16A1 Rifle with Noise Suppressor, HEL, M4.

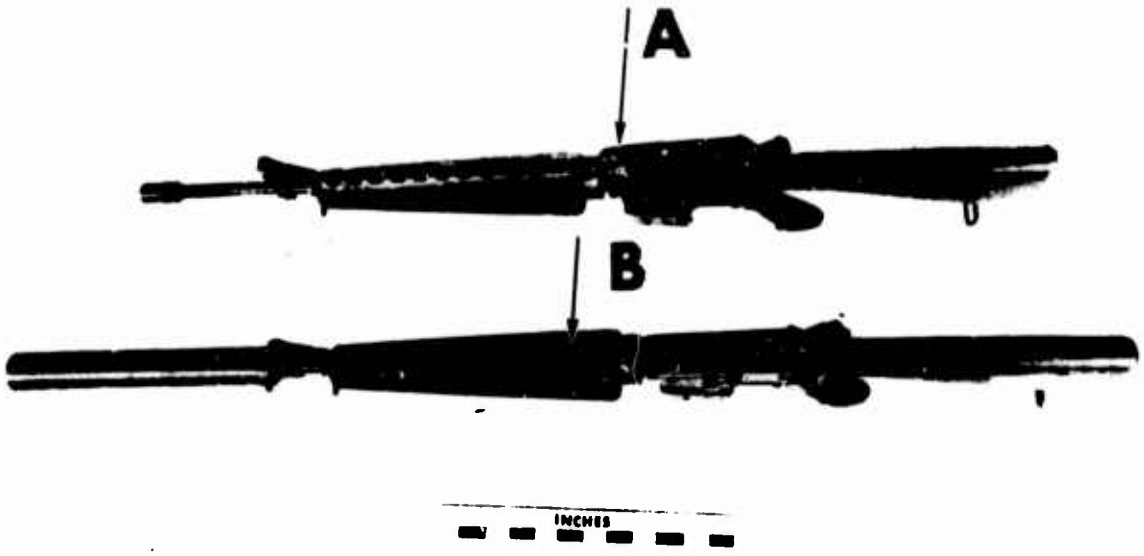


Figure 18

Center of Balance

A. Arrow Indicates Center of Balance of Loaded M16A1 Rifle.

B. Arrow Indicates Center of Balance of Loaded M16A1 Rifle with Noise Suppressor, HEL, M4, Attached.

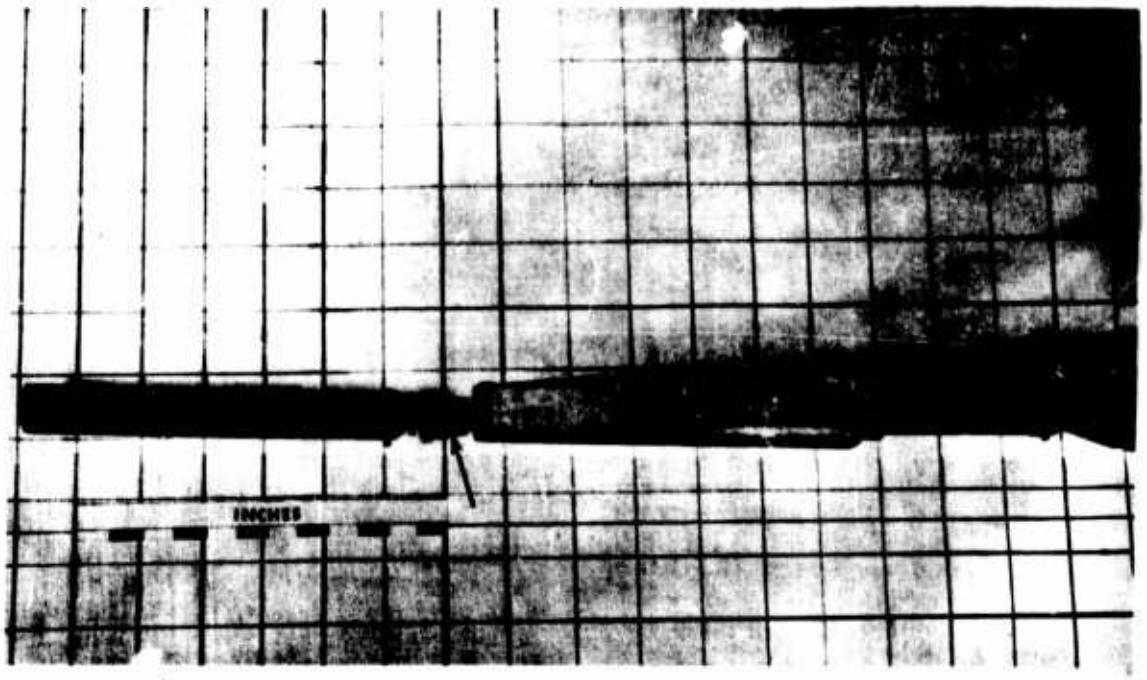


Figure 19

Arrow Indicates Bend in Barrel of M16A1 Rifle with Noise Suppressor, HEL, M4, Attached, Caused when Parachutist Attempted Left Parachute Landing Fall and Weapon Hit the Ground.

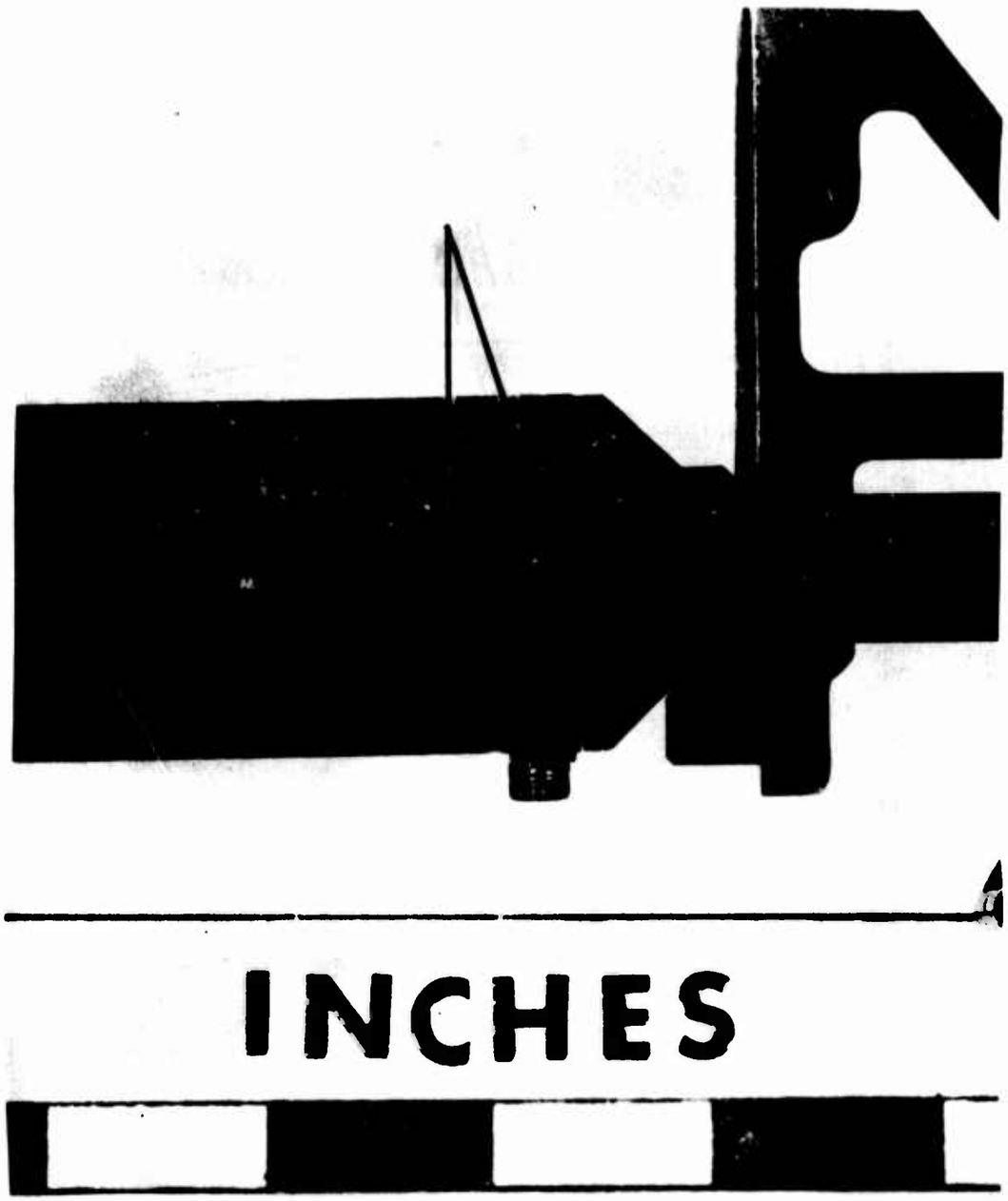


Figure 20

Arrows Indicate Loose Mounting Screw and Mounting Screw Hole in Noise Suppressor, HEL, M4, Mounted on M16A1 Rifle.

APPENDIX III. DEFICIENCIES AND SHORTCOMINGS

1. DEFICIENCIES

Deficiency	Suggested Corrective Action	Remarks
None		

2. SHORTCOMINGS

Shortcoming	Suggested Corrective Action	Remarks
2.1 The gas deflector does not deflect all of the escaping gases from the firer's eyes.	Unknown	Subtest No 2.
2.2 The ejection pattern of the test weapon constitutes a safety hazard to a left-handed firer.	Unknown	Subtest No 2.
2.3 The test weapon exhibits an unusually high malfunction rate during automatic fire.	Unknown	Subtests No 6 and 8.

APPENDIX IV. REFERENCES

1. Letter, AVC-O&T, Headquarters, USARV, 20 May 1966, subject: "Silencer for the M-16 Rifle (ENSURE)."

2. CONFIDENTIAL message, AVHGC-DST 35173, 24 May 1967, subject: "Silencer for the XM16A1 Rifle (U), ENSURE Nr 77."

3. Letter, AVHGC-DST, Headquarters, USARV, 25 September 1967, subject: "Evaluation Plan - Silencer for the M16A1 Rifle (ENSURE #77) (U)."

4. Letter, AMSHE-SYS, USAHEL, 11 December 1967, subject: "HEL, M4, Noise Suppressor," with inclosure.

5. Letter, AMSTE-BC, USATECOM, 25 January 1968, subject: "Military Potential Test of Noise Suppressor for M16A1 Rifle, USATECOM Project No. 8-8-0200-13."

6. US Army Infantry Board Project 3239, Plan of Test for Military Potential Test of Noise Suppressor, HEL, M4, for M16A1 Rifle, February 1968.

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13. ABSTRACT

The Military Potential Test of the Noise Suppressor, HEL, M4, for the M16A1 Rifle, was conducted by the US Army Infantry Board from 1 Feb 68 to 26 Mar 68 at Ft Benning, Ga. The purpose was to evaluate the advantages and/or disadvantages of the noise suppressor in realistic operational exercises characteristic of Vietnam environments with respect to such factors as position disclosing effects, system functioning, durability, reliability, and maintenance. Fifteen M16A1 rifles with noise suppressors attached were used to conduct this test. Fifteen standard M16A1 rifles were used for control purposes. Specific phases of testing under temperate climatic conditions included physical characteristics; safety; signature effects; known distance accuracy; quick fire; durability and reliability; portability and aerial delivery; maintenance; human factors engineering; and value analysis. There were no deficiencies; three shortcomings were noted. The gas deflector failed to deflect all of the escaping gases from the firer's eyes; the ejection pattern of the M16A1 rifle with the noise suppressor attached caused the expended cartridge to strike the cheek of left-handed firers; and the malfunction rate of the test weapon was unusually high.

It was concluded that the Noise Suppressor, HEL, M4, had military potential and accomplishes the purpose for which it was designed, i.e., to deceive observers located forward of the test weapon as to the location of the weapon when it is fired. It was recommended that the Noise Suppressor, HEL, M4, be considered as having military potential, and further development be directed toward correction of the shortcomings.

DD FORM 1 JAN 64 1473

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Noise Suppressor Muzzle flash and noise Smoke Flash Suppressor						

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